University of Alberta

Caring for students and caring for mathematical ideas in an elementary classroom

by

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Ce travail est dédié à Patrick, avec reconnaissance et grand amour.

ABSTRACT

Elementary teachers are known as carers, but this simplistic characterization ignores the emotional, intellectual, and moral work that is inherent in teaching. Elementary teachers' care for students and their care for mathematical ideas can complement one another, but the two can also be incompatible. How does a teacher in an elementary classroom care both for students and for mathematical ideas? What are the complexities of caring both for students and for mathematical ideas? How are the complexities related to and shaped by the subject of mathematics? These are the questions guiding my study.

Teachers care for students, but they also care for the ideas of an academic discipline. Much of the work of human care is based on the individual, and not the general, case. Conversely, mathematics emphasizes generalizations, such as theorems and formulae. Generalizations have an air of 'not caring' about particulars. The formula does not care *what* numbers are used, nor the theorem *which* right-angled triangle is considered. Indeed, an ethic of care challenges general rules and principles.

A case study, informed by both narrative inquiry and phenomenology, took place over a period of four months with one elementary classroom teacher and her Grade 6 students. Through a variety of field texts, I wrote a fictionalized collage of actual classroom events. Three characteristics of care were examined including profound attention, reciprocity, and proximity. Three classroom accounts focused on indifference, mistakes, and conjecturing revealed aspects of care within the teaching and learning of mathematics. I attended both to the

complexities in the classroom milieu as well as to contexts such as the history of mathematics and mathematics education.

By exploring the complexities of care, my study re-examines and honours the emotional, intellectual, and moral work that is inherent in teaching both students and mathematics. My study revealed that caring for students and caring for mathematics are not independent forms of care, but interplay in complex, and sometimes synergistic, ways. Teachers can draw on care for their students to care for mathematical ideas and care for mathematical ideas can become a site for expanding care for students.

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CHAPTER 1: ROOTS OF CARE

As the eldest child of a social worker and an elementary school teacher/administrator, care is part of my birthright. My parents' respective professions have elements of care giving and caretaking. I have drawn on experiences of being cared for in my family to help me in my teaching and research. My current relationships with my husband, parents, brothers, extended family, and friends can also be described as caring. These relationships have sustained my ability to care for my students.

I call this chapter *Roots of Care* to indicate that care is part of my heritage as well as a system of relationships that grounds my life. In this chapter, I explore both of these ways of thinking about care: as part of my family stories and as a life anchor, especially in my teaching career.

As I think back to the roots of care in my life, I turn to the unusual child minding arrangements that shaped me.

> *When I was born in May 1973 in Grand Falls, New Brunswick, my mother had been teaching. There was no maternity leave at that time and new moms were expected to take sick leave. My mom had no sick leave left and had to borrow fifteen days of time to give birth to me. My aunt and uncle moved into my parents' house and took care of me when my mom went back to work in June. She was soon off for the summer. My uncle had just finished university. My dad continued to work as a social worker.*
>
> *In August, my mom returned to teaching and my maternal grandfather, who was in his seventies, took care of me during the day. My mom and dad dropped me off at his house on their way to work in the morning. They had lunch at my grandfather's house and picked me up after work. My mom says that I was an easy baby.*
>
> *After my brother Chris was born in 1975, my mother spent many years at home caring for us. She returned to work when my second brother Bruno was very young. For a time, we moved away from Grand Falls and from my grandfather's care. I remember one babysitter named Jane. The niece of our neighbours, Jane was Afro-Canadian and loved to draw. There were very few other babysitters in our life; my family members cared for my brothers and for me. When we moved back to Grand Falls, we moved in with my grandfather, who provided full-time care for Bruno and after-school care for Chris and me.*
>
> *My aunt, uncle, and grandfather were my primary caregivers, along with my parents. My parents had had similar experiences as children. My mother is the youngest of seven in her family. Her siblings, a cousin, a*

> *neighbour's child, and her grandparents all lived on her parents' farm. They each had a role to play in childcare. My father is the eldest in his family. His mother worked as a hairdresser in her home and cared for her eight children. His father worked full-time across the street in his garage/gas station. There were many aunts, uncles, cousins, and grandparents nearby to help.*

I begin with these memories, my own and those of my close family members, because it is the living out of care in all its forms that provides the source for an ethic of care (Noddings, 1984).

My birthright of care goes beyond child minding. I think of my parents' attitude toward people outside our family, mainly the people in their work lives. My father was often deeply affected by and involved with his social work. He had a strong emotional connection to his clients, particularly when he worked with abused children. He sometimes told us in general terms about their difficulties, while reminding us how happy he was to be our father and to be able to love us so much. Because these kids seemed so close to his heart, in junior high school I wrote a speech about his work. My father's connections to his own children continue to deepen. My dad still calls me regularly to chat.

My mother's work as a teacher and school administrator also influenced me. In elementary school, I was a student at the francophone school across the schoolyard from the anglophone school where my mother worked. I remember her involvement with students and teachers, negotiating learning, family, and discipline issues with care. She did planning and marking alongside my brothers and me as we did our homework at the kitchen table. When I was in Grade 5 or 6, my mother asked me to record myself reading books she had selected. These were for students who had learning difficulties. They could listen to the tape while following along in the book. This also provided a voice more like theirs than an adult's. Perhaps this was the beginning of my teaching career. I remember taking the task very seriously and sitting on the floor of my bedroom with the door closed, having given a warning to my brothers to be silent during the taping. Caring for others, especially for children, continues to pervade my mother's life.

My own teaching career began when I was physically far away from my family. After completing a Bachelor of Science, I worked as a volunteer math and science teacher in a high school in the Federated States of Micronesia. A volunteer organization prepared and supported me, but it was my memories of my family and my life in schools that most strongly shaped those two years of living and teaching overseas. My parents spent a small fortune phoning me every Sunday afternoon. My mom also wrote to me regularly and encouraged others to send notes and letters.

As I planned my lessons and stayed up late marking, sometimes by the flame of a kerosene lantern, I drew on what I knew about teaching, learning, and caring. I thought about the individual students and about the whole class. The textbooks and materials were old, but my students and I found ways to bring the subject matter alive. I thrived on the students' curiosity and response. Working at the school was truly an around-the-clock job, as I lived on campus with other staff members and all the boys. The girls were billeted with families on the island. They travelled to the campus early each morning and left late in the afternoon.

We teachers held morning and evening office hours and spent many weekends on school activities. While this was tiring and often frustrating, the students truly appreciated our work and found ways to acknowledge our commitment to them. They joked with us and sought our advice. They smiled often and easily. They worked hard on their studies. Years later I met one of the graduates. He spoke so appreciatively of my time as a teacher that tears spring to my eyes even now as I think of him.

My family indelibly marked the life that I made in Micronesia. It is my parents' example of care that inspired me to volunteer overseas. It is the life that they made with me, my brothers, and our extended family that showed me how to be with other people and to appreciate caring relationships. Beginning with my time in Micronesia, I transformed my birthright into my vocation and my career.

Upon my return to Canada, I completed a Bachelor of Education and moved back to my hometown to work as an elementary teacher at the K-12 school from which I had graduated. My mother became my vice-principal. I moved in with my parents. We spent many meals and evenings discussing the happenings in my class. They became my mentors. Even after I moved out of their house, I relied on their years of experience to help me care for my students and their families, and for myself as a professional adult.

My duties included teaching most subject areas to French Immersion students in Grades 4 and 5. Typically I stayed with the same group of students for two school years; we inhabited the same classroom space and maintained many of the same routines and practices over the two years. To facilitate the teaching of fine arts and physical education subjects by specialists, I traded off with other teachers, teaching their students mathematics as they taught my students English Language Arts. I became a mathematics specialist of sorts, planning whole-school mathematics events, presenting mathematical problems and ideas at staff meetings, and holding an additional position of responsibility in math and science. My colleagues supported my interest and delight in mathematics.

I carried my enthusiasm for mathematics into the classroom and into my teaching plans. I spent many hours thinking about what to do next, for which students, and how. Though I cared for my students for their learning, I was continually surprised at the complexity of teaching. I was constantly making decisions, considering possibilities, and weighing what was right for students and for their learning. One Friday morning I mused about Craig. The mathematics question-of-the-week was due that day. Should I ask Craig early in the morning if he needed help? Or should I trust that he had been able to do it on his own? How would he feel if he had already completed it and I asked him if he needed help? If he had had difficulty and I failed to offer my help, how would he learn the mathematics? If he needed help and I offered it before he sought help, how would he learn to ask for himself? So many questions for one situation. And the bell was about to ring.

Care is complex, especially when my care for people and my care for ideas interact. As a teacher of elementary school students and of pre-service teachers, I have sometimes noticed these complexities as I plan or evaluate student work. At other times, the complexities have emerged during fleeting classroom moments like the one where I considered possibilities for working with Craig.

In terms of evaluating student work, I think particularly of assignments for pre-service teachers. I often furnish deliberately imprecise criteria for my assignments, so that my students feel some freedom to express their thinking, so that they do not have to conform to narrow conditions. But I also take into account what I know about learning and what I know about my students. I think about my previous classroom experiences. I think about who my students are and how they have been working with others and with ideas. I care for them as learners, leaving them room to grow toward their own better ethical selves. At the same time, I care for the ideas of mathematics. I choose questions and problems carefully, considering the mathematical ideas that I think are important. This combination of imprecise criteria and challenging mathematics has led to some of my students becoming frustrated and even angry. While I intend to demonstrate care as I set assignments and evaluate student work, my students may not receive or acknowledge my care.

I feel another kind of tension[1] as I direct attention in the classroom. I know that talking and listening are important both in learning mathematics and in developing caring relationships, but it is hard for me to decide when to direct students' attention. Sometimes students talk with others when I think they should be listening. I might say something to them, politely. Other times, when I think that they are helping each other to make sense of an idea, I do not redirect their attention even when their talking may disrupt others. It may seem obvious that attending to one another is critical when it comes to care, but it can also be problematic.

The complexities of care were amplified when I became a graduate student and was once again the person cared for in teaching and learning relationships, a position with less responsibility than that of a teacher. As a teacher, where I have great responsibility toward students, I feel uncertain, hesitant, un-knowing, and overwhelmed when I have moments of tension around care. I feel the importance of my decisions about teaching and learning as I consider their potential effects. As a graduate student, a receiver of care, I have felt free to pursue the projects and interests I choose. As a teacher, it is most important to care for my students as people. As a graduate student, I care for my teachers through my responses to intellectual challenge; that is, as I care for ideas. As I move between these roles of teacher and student, sometimes within the same hour, I feel a subtle shift in responsibility, in my orientation towards care for people and for ideas.

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[1] I use the word *tension* to indicate the intensity of care as well as the ways in which teaching and learning have challenged and expanded my own views of care. See Mason (1988) and Breen (1993) for interesting explorations of tensions in teaching.

Each situation I have described (thinking about Craig, evaluating student work, directing attention, and being a graduate student/teacher) instantiates a moment of care. In examining my teaching, I have found that in many of these moments of care I consider the possibilities for my students, for their learning, and for the subject matter. As I imagine what could be—the essential space in which a teacher operates—I care both for my students and for mathematics. These experiences have led to my present research. The question that frames my case study of one teacher and her Grade 6 students is: **How does a teacher in an elementary classroom care both for her students and for mathematical ideas?**

I suspect that these two forms of care (and there are more) interact in complex ways. I use the word *complex* in a general sense, not to indicate a particular scientific idea or philosophical stance. Care, as I have described it from my teaching moments, holds tension for me as I think about my students and about the subject matter we explore in the classroom. Care for people and care for mathematical ideas can happen together, but they require work, such as when a teacher cares for her students by engaging them in mathematical problem solving. The complexity of care emerges as teachers consider the possibilities open to them and to their students.

The subject matter of mathematics highlights some particular complexities of care. Individual students depend on direct involvement with the teacher. At the same time, the teacher must care for the ideas of an academic discipline. Mathematics emphasizes generalizations, such as theorems and formulae. Conversely, much of the work of human care is based on the particular, and not on the general case. An ethic of care challenges general rules and principles. More questions arise: **What are the complexities of caring both for students and for mathematical ideas? How are the complexities related to and shaped by the subject of mathematics?**

Through this study, I bring a caring perspective to school mathematics content. Though my aim is to describe the richness of care in one classroom, I also look through caring eyes at the discipline of mathematics, enacted curriculum, and resources in the elementary classroom. Care may be an unusual or unexpected angle for examining mathematics. The interactions among care and mathematics are largely unexplored terrain in academia, though the territory may feel familiar to teachers and their students. Through this study, notions of care and of mathematics will be both complicated and sharpened as I research their relationship.

Throughout the rest of this chapter, I illustrate theoretical and philosophical perspectives with moments from my own life as a teacher. First, I explore care from a theoretical perspective, viewing research on moral reasoning by Lawrence Kohlberg[2] and Carol Gilligan as the roots of Nel Noddings's ethic of care. I include common descriptions of care and an exploration of the word *care* in order to clarify what I mean by the words *care* and *caring*, as well as to point out some linguistic intricacies.

Why Care?

I begin my exploration with a discussion on moral reasoning as it relates to care. Moral reasoning may seem like a strange place to start in research about mathematics in an elementary classroom. Indeed, mathematics has a reputation for being *amoral* insofar as it is considered to be a body of knowledge, even though applications of mathematics (such as engineering weapons or water pumps for drought-stricken areas) have moral dimensions. Many people view mathematics as a set of rules and procedures to be followed to find an answer, without regard for the moral worth of the answer. Mathematics is popularly described as a black-and-white discipline that does not consider the grey areas that accompany moral reasoning. Many students experience school mathematics as a "depersonalized, uncontextualized, non-controversial and asocial form of knowledge" (Brown, 1996, p. 1289). Mathematics becomes associated with conventions, rules, and algorithms. How can such a subject, ruled by numbers and procedures, have morals or be associated with care?

One way to connect care and mathematics is to draw a parallel with moral reasoning based on conventions and universal principles. Lawrence Kohlberg (1981) described moral reasoning as consisting of "universal levels of development" (p. 16). He specified six moral stages, or orientations:

> *Stage 1. Punishment and obedience*: The focus is on the immediate consequences of action. Obedience springs from trying to avoid punishment.

---

[2] In this dissertation, I have included the first names of authors for a variety of reasons. First, I have met some of the authors and feel comfortable naming them. Second, considering the topic of care, I think it is important to point out that these authors are real people with whom I have a relationship (sometimes only through their writing). Third, when a reader is searching for more information on authors, it can be helpful to have their full names.

Stage 2. Instrumental relativist: People make decisions by trying to satisfy their own needs and sometimes the needs of others. The stage can be summarized by reciprocal actions.

Stage 3. Interpersonal concordance or 'good boy-nice girl': People's actions are shaped by how their actions might please others.

Stage 4. Society maintaining: Decision making centres on maintaining social order.

Stage 5. Social contract: People base what is good or right on individual rights and societal values. This could be termed a legal orientation.

Stage 6. Universal ethical principle: People are guided by universal principles: a sense of justice and conceptions of equality.

When I teach, Kohlberg's six stages are not helpful to me. A situation such as the one I described about Craig and his homework requires reasoning that is complex and real. In a broad sense, it can also be considered moral reasoning since I consider what is good or right for the situation and for the people involved. Kohlberg's stages are based on research with hypothetical dilemmas, not on real people in real situations. For me, mathematics is more than applying procedures, just as moral reasoning about real dilemmas is more than applying universal principles. Though conventions, rules, and algorithms are important to mathematics, they do not contain the discipline, just as universal principles of moral reasoning are but a part of an ethical life.

And yet I find Kohlberg's research interesting. I can understand how, within a complex world of choices, a stage theory would seem comforting and certain. There are people who stand out in a positive sense when it comes to their moral choices: Mahatma Gandhi, Martin Luther King Jr., and Mother Teresa. Kohlberg's stage theory captures, in a snapshot, a great variety of moral orientations. It also provides a starting point to understand some motivations for decisions. These motivations might offer openings in schools for conversations around moral choices.

Carol Gilligan (1982), a psychologist, professor, and colleague of Kohlberg, writes about another way of thinking about moral reasoning based on relationship and responsibility. In her research on moral conflicts and choices, Gilligan re-analysed Kohlberg's data and found that his theory of moral development did not adequately describe the complex moral reasoning of many participants in her studies, especially the reasoning of girls and women.

Kohlberg's six stages were developed based on research done with boys and men. When using Kohlberg's stage theory, researchers such as Gilligan ranked women's moral reasoning in the lower stages. And, though there seemed to be a pattern with regard to women's moral reasoning, Kohlberg did not re-examine the data he had collected. Gilligan argues that the women's moral reasoning was not inferior, but that their bases for making decisions were very different. Women tended to emphasize contextuality and connection to others, while men gravitated toward individual rights and universal principles such as justice, which was a guiding orientation in Kohlberg's stage theory. By reporting Gilligan's work here, I do not mean to imply that all women reason in one way and that all men make moral decisions in another. I simply wish to describe more than one way to think about complexity as it pertains to care.

The application of Kohlberg's stage theory simplifies moral reasoning as well as normalizing the child; there is a normal (male) way of proceeding through the six stages. The hierarchical stages imply that there is a natural child with a natural development and that all children should develop in this way. The stage theory mathematizes morality: all cases of moral reasoning are generalized into six stages even though not all cases have been examined. Girls and women did not participate in the original research that led to the stage theory; their cases were ignored.

Valerie Walkerdine (1990), a critical theorist with an interest in class and gender as well as in early mathematics, writes about how human development is "specific to social and historical circumstances" (p. 55). She questions the idea of normality by showing how we can think of development as a set of practices in different contexts with specific discourses. By judging girls and women against a system and, in this case, a theory rooted in male, middle-class morality and normality, girls and women are seen as abnormal. Walkerdine goes further when she writes, "some fiction is being created to account for what it is necessary to prove time and time again: the inferiority of the Other. The Other constantly threatens the dominant group and no end of fantasies and fictions are employed to position the oppressed subject as Other, pathological" (p. 55). Walkerdine questions what is normal in human development and how images of normality shape general constructs about people.

In response to the application of Kohlberg's stage theory, Gilligan puts forth an alternative theory of moral development, one based on care and relation to people, not on a general construct such as *the child.*

Another way to connect care and mathematics is to draw a second parallel, this time between general constructs such as *the child* or universal stages of development and mathematics. People create and do mathematics. It is a human activity, just as teaching and learning are human activities. Conventions, rules, and universal principles may be useful tools for mathematics and for guiding the teaching of mathematics, but they ignore, or are indifferent to, the fundamental connections among the people in the classroom, and even the connections between people and ideas.

To acknowledge mathematics as a creative human, social, and cultural enterprise that involves emotions and intellect has implications for the classroom. Larry Copes (1982), in describing his use of a model of teaching and learning, writes that "mathematical experiences can serve as powerful forces for [intellectual, ethical, and identity] development, perhaps, in part because they commonly are not expected to do so" (p. 43). Instead of confining their learning to an established set of rules, students *do* mathematics. Instead of exclusively teaching procedures[3], teachers prepare and enact contexts in which students may do mathematics. Teaching, learning, and mathematics are not limited to universal rules; the teaching and learning of mathematics emerge in moment-to-moment action. When they recognize mathematics as a product of human minds, teachers go beyond the universals; they compose curriculum based on the particular students who are in the classroom as well as on the specific mathematics they engage in together. Teachers can care both for people and for mathematical ideas.

I use the word *care* deliberately. Nel Noddings, a mathematics educator and philosopher, suggests that care is another way to think about moral reasoning and action in a teaching context. This is not simply the care of "gentle smiles and warm hugs" (Rogers, 1994, p. 33), though an ethic of care does not preclude these on occasion. An ethic of care is based on the psychological research and writing of Gilligan and recognizes our fundamental relationship to others, especially to the people in our everyday lives.[4] Moral reasoning under an ethic of care is concerned with "maintaining and enhancing" (Noddings, 1984, p. 42) relationships amongst real people, not with the application or rearrangement of general principles.

Noddings's ethic of care originates in people's memories of caring and being cared for. It is based on a feeling of "I must do something" (1984, p. 25) as the cared-for's[5] reality becomes a possibility for each person. She claims that care is characterized by motivational displacement, engrossment, and movement towards an ethical ideal. It is differentiated in human care (as opposed to care for animals[6], plants, and ideas) by reciprocity, of attention being returned and the possibility that the cared-for can become the carer.

Care involves entering into a relationship with another person (Noddings, 1984). The carer encounters and accepts the person who is cared for. Motivational displacement occurs as the carer focuses on what is important to the cared-for and not on himself or herself. When a teacher becomes a carer, the teacher's agenda, for time and maybe also for curriculum, falls away and becomes secondary for a moment or longer.

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[3] I wish to emphasize that rules and procedures are important to mathematics, but that there is also much more to the discipline.

[4] Belenky, Clinchy, Goldberger, and Tarule (1985) have labelled this connection to others, in terms of intellectual development, as women's ways of knowing.

[5] Noddings uses the term *cared-for* as shorthand for *the person being cared for*. I will also use this term.

[6] Noddings (1984) points out that animals are responsive to care and can be "genuine cared-fors" (p. 149). However, the reciprocity that characterizes human relationships, a "dynamic potential" (p. 156) for the cared-for to grow into a carer (for people, ideas, animals, plants, etc.), does not exist with most animals.

The carer becomes engrossed in the cared-for, listening attentively and responding dynamically. A caring teacher focuses on the student that he or she is working with, attending to the student's words, actions, and body language as well as to what he or she already knows about the student.

Care also involves growing toward a better ethical self, called an ethical ideal. Noddings (1984) writes that an ethical ideal is "our best picture of ourselves caring and being cared for" (p. 80). That best picture is shaped by relationships with others and experiences of care.

As the cared-for recognizes and responds to the carer, caring is completed. This returning of attention, or reciprocity, is not a contractual obligation; the reciprocity is in the maintenance of care and it is the way the cared-for takes part in the relationship. Reciprocity takes many forms, including sharing daily joys and challenges, and engaging in intellectual pursuits.

To summarize, a caring relation is characterized by engrossment and motivational displacement on the part of the carer and is completed by response from the cared-for. Both the carer and the cared-for shape and strive for an ethical ideal within caring relationships.

Describing Care

I have begun to describe Noddings's notion of care, but the words *care* and *caring* have many other uses. In order to clarify my use of these words, I now explore their general uses[7]. I also describe my meanings for these words in the context of this study.

The word *care* is often used in the context of health or medicine (health care, skin care, prenatal care, palliative care). It implies that a person is taking care of another or of himself or herself. The terms *child care* or *daycare* are also used in this way. It is this idea of taking care to which I will first turn my attention.

Taking care reminds me of caretaking. Both of these uses of care include the word *take*, as in *to use* care. I might speak of taking care of business, taking care of a relative, or of being a caretaker for a house or a pet. There is a sense of efficiency and maintenance. This sort of taking care is not what I mean to invoke by my use of the words *care* and *caring*.

Another sense of taking care or *being careful* has to do with attention and appearances. I think particularly of schoolwork that is done carefully: it is neat and the student has put time, attention, and thought into the production (Bills & Husbands, 2004). Though this sort of care is not specific to mathematics, a teacher may emphasize it because mathematical work may be very concise. Small surface differences[8] can prove significant in an answer, a proof, or a notation (e.g. xy, x^y, and (x, y) all have different meanings).

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[7] For instance, Noddings explores care as empathy (1984, p.30).

In the same vein, there is also an aspect of taking care that is particular to mathematics. It has to do with precision and attention to detail. The symbols that represent numbers and operations in mathematics function in a certain way. For example, the sum of 21 and 22 is not the same as the sum of 12 and 22. Though all the digits are the same in both additions, the symbols cannot do their work for me if I do not take care with their position and related meaning. But again, this is not the sort of care that I think is fundamental to work with others. However, the qualities of time, attention, and thought are all important both in careful work and in caring relations with people.

The word *care* may also mean 'being in someone's charge or under their supervision'. This is a form of taking care that is associated with child minding and medical attention. Sometimes these roles, and other related roles, are also called *caregiving*. Though I like the sense of people giving their care freely to one another, especially to children and to those who are ill, this is still not the sense that I give to care and caring, though my definition includes both *giving* and *taking* care.

I have paid attention to how *care* and *caring* are used in media, literature, and everyday speech. This has not been an exhaustive study, but I have noticed some examples that help clarify the terms I use. I focus on *giving* and *taking care*, and on *caring for* and *about*.

I find it interesting that *giving* and *taking*, usually antonyms with reciprocal recipients and donors[9], are used as synonyms with respect to care. For example, when my goddaughter is minded outside of her home during the workweek, a care*giver takes* care of her. In this context, *giving care* and *taking care* have similar, if not identical, meanings. The mixed meanings signal difficulty with the ideas involved. The synonymy of giving and taking care also signals the reciprocity that is one of Noddings's defining characteristics of an ethic of care.

To further trace the contours of *giving* and *taking* care, I turn to my other language, French. There is no one-word French equivalent of *care*. One translation is *prendre soin* or *donner des soins*, which mean to take care and to give care(s), respectively. Again, the expected antonyms have the same meaning. *Soin(s)* is not a direct translation of *caring*. *Soin(s)* is a noun while *to care* is a verb. In French, the action of caring is carried by the ideas of giving and taking.

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[8] See Chapter 5 for more on mistakes.

[9] For example, in a healthcare setting, the person giving his or her blood and the person taking that blood are normally not the same person, though autologous blood transfusions do occur. Their roles are different but they depend on one another. The person giving blood may presuppose that there is someone else in need of it, while the recipient understands that there must be a donor.

Care can also be translated as *s'intéresser à*, *être concerné par*, or *être attaché à*. Loosely translated, these signal interest, concern, and attachment, respectively. These three areas are all part of what I mean by the word *care*. Though the word *care* has indistinct boundaries and a variety of meanings in English, it is a rich and meaning-full word. In French, I cannot say that I care in the same way that I can say it in English. In French, I cannot say that I care for my students; I can say that they are important to me, that I am interested in them, that I am concerned for them, and that I am attached to them. In English, all of these meanings and more are wrapped up in one word: *care*.

I also find it interesting to consider the prepositions that usually follow the word *care*. Noddings uses *caring for* to explain the special sort of relationship described by an ethic of care. I hardly use the term *caring for* except when I write and talk about Noddings's work. I have found few instances of *caring for* in literature. It often refers to liking (i.e., Would you *care for* some milk in your tea?) or healthcare (i.e., Nurses *caring for* their patients). Along the highways of Alberta, signs declare, 'Caring for Alberta's highways.' Below those words is a tab bearing the name of a group that has collected litter along that stretch of highway. This *caring for* has to do with caretaking and maintenance. None of these uses of *caring for* (liking, healthcare, or maintenance) is what I mean when I use the term. Rather, I follow Noddings, invoking motivational displacement, engrossment, reciprocity, and movement toward an ethical ideal in relation to people and ideas.

I have also monitored my use and observations of the words *caring about*. I only use *caring about* in the negative form: "I don't *care about* that." Usually I mean that one thing does not matter in the face of another. For example, "I don't care about the onions (as long as supper is ready soon)." There is a taste of indifference in this use, which I explore in Chapter 5 with respect to mathematics. Noddings also differentiates between *caring for* and *caring about*. She describes *caring for* as an actuality, while *caring about* is a "verbal commitment to the possibility of caring" (1984, p. 18). Though she does not explore these distinctions in depth, I use both *for* and *about* to invoke an ethic of care.

The *not caring about* that I have described is one non-example of care that clarifies the characteristics of care that are relevant to my study. *Not caring* implies that there is little or no motivational displacement, engrossment, or movement toward an ethical ideal. I think of the people with whom I ride the bus in the morning. In one sense, I do not care for them as I sit reading an article or thinking about what to eat for supper; there is no engagement between us. I sit quietly and respect the personal space of those around me. These conventions of public behaviour protect me (and others) from too much caring. The seeming indifference in my attitude toward people on the bus is one way to retain the energy needed to care for the people closest to me. But I might start to care for a person on the bus. If the person next to me asked for directions, I would stop reading and try to help him or her figure out which bus to take next. I cannot care to the same degree for every person in the world; the 'I musts' I feel for people in the relationships closest to me are different from those I feel for strangers. But I can still remain open to caring for those who are not in my most intimate circles of care. The potential for care can exist even in *not caring*.

This idea of *not caring* is particularly important in a classroom. In class, I have tried to care for students and ideas by asking questions, guiding discussion, giving time for work, and not telling answers. Not telling answers may on the surface look like *not caring*. Caring may be equated with helping. Sometimes, caring is helping. Suppose my neighbour, with her arms full of groceries, is trying to unlock and open the front door of the building. Care in this situation might include helping her by unlocking, opening, and holding the door for her.

Gilligan (1982) describes the development of moral reasoning in women as focusing on relationships and interconnection; *helping* is at the heart of maintaining and sustaining relationships and interconnections. "The moral person is one who helps; goodness is service, meeting one's obligations and responsibilities to others, if possible without sacrificing oneself" (p. 65-66). Thus, it is morally right to help. How then can a teacher, especially a woman, deny help by not telling an answer, by not giving a hint, by seeming to ignore a student's struggle to understand?

In a classroom, to help by telling an answer or giving a hint might look like care. In the context of my study, however, it may actually be a form of not caring for people or ideas. The distinctions between caring and not caring are not always easy. As a teacher, I do not disappear when students became overly frustrated with a problem, leaving them "stewing in [their] own juice" (Brown, 1991, p. 3). But I might not tell them an answer either. Persevering through frustration may be part of an ethical ideal. A teacher thinks not only about the individual student, but also about that student's future self. This attitude produces a different sort of learning and a different sort of caring.

By examining various uses, definitions, and descriptions of *caring* and *not caring*, my aim is to clarify the word *care* as I will use it in this study and to point to some linguistic difficulties. I started with common meanings of *care* that imply maintaining the status quo, paying attention to appearances, fastidiousness, and supervision. In this study, I use *care* to signify attention, sustained interest, concern, attachment, motivational displacement, engrossment, reciprocity, a sense of connectedness and relationship, and working toward an ethical ideal. One area that requires further discussion is *not caring*, or indifference, in mathematics. I will address this idea in more depth in Chapter 5.

In this chapter, I have examined the roots of care: my own care, an ethic of care, and idiomatic aspects of the word *care*. These roots extend deep into the soil of my existence, anchoring, nourishing, and linking my personal, relational, familial, teaching, learning, academic, and intellectual lives. In addition, these roots have given rise to my research questions: **How does a teacher in an elementary classroom care both for her students and for mathematical ideas? What are the complexities of caring both for students and for mathematical ideas? How are the complexities related to and shaped by the subject of mathematics?** In the next chapter, I describe some of the relationships among my research and the writing of other academics.

CHAPTER 2: CARE-RELATED LITERATURE

In conceptualizing my study, I draw on the work of researchers in the field of education. I think about what I do that is in keeping with their ideas, and also about what makes this study distinct. I am inspired by mathematics educators, but researchers in other areas, such as early childhood specialist Lisa Goldstein, are also exploring care. In this first section, I give an overview of the research in education that has shaped my study. In the second section, I broadly examine care in other fields such as social work and nursing. In the third section, I respond to some critiques of an ethic of care. In the fourth section, I look at care as a philosophical subject. Finally, I examine research around care in the context of mathematics.

Care and Education

Nel Noddings (1984), a former mathematics teacher, writes persuasively about caring. The examples she uses to support her arguments are brief but believable. Different people in different situations, many not school-related, each shed a particular light on the idea she discusses. In a later work, Noddings (1992) elaborates on care in schools. She writes of alternative school structures, especially for high school, which emphasize care for the student. The instances she describes and the alternatives she presents help me to imagine what care might look like in an elementary classroom. I am inquiring into caring as one teacher and her students experience it, with all its dilemmas as well as its congruities, in an actual classroom, over time.

Using Noddings's description of an ethic of care, my study examines how one teacher in an elementary classroom cares both for students and for mathematical ideas. By exploring the forms of care involved in caring for people and caring for ideas, I build on and extend Noddings's broad view of caring to the classroom of one teacher, Karen Marks[10], and her students. Specifically, I explore Noddings's characteristics of care in the context of Karen's mathematics teaching. I also enlarge the idea of proximity, a topic that Noddings mentions but does not elaborate on.

Magdalene Lampert, a mathematics education professor and researcher, describes classroom practice to an academic community. She portrays reform-oriented mathematics in her own practice. In *Teaching Problems and the Problems of Teaching*, Lampert (2001) documents her teaching for an entire school year in an elementary mathematics setting. She writes about what it was like to make decisions with both her students and the mathematics in mind. I also examine teaching, but through the lens of care, to see how the challenges of teaching children and the teaching of mathematical problems look to the teacher and to an outside researcher.

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[10] The names of all participants in this study are pseudonyms.

Lisa Goldstein specializes in early childhood educational theory, curriculum, and teaching. She has undertaken a study similar to mine, but not specifically in the area of mathematics. Goldstein, a former student of Nel Noddings, was a participant-observer for three months in the multi-age primary classroom of Martha George, a teacher with ten years of experience. Goldstein (1998) interprets Martha's curricular and pedagogical work through an ethic of care to show the "careful and deliberate decisions linked to Martha's own understanding and interpretation of the principles of caring educational practices" (p. 254). Most people take for granted the care that is usually associated with early childhood workers; it is considered to be a natural part of women's work with young children. Goldstein uses her study to re-interpret the work of early childhood educators by recognizing care as a tradition in early childhood education and considering care as a framework for understanding teaching and learning.

Goldstein provokes me to consider the work of care in the classroom, especially with respect to the traditional roles of women. People, including researchers in education, frequently underestimate the work of care, perhaps because the inherent complexity is not readily observable or communicated. Goldstein makes plain the work in which Martha is engaged by enlarging fleeting classroom moments. Like Goldstein, I attend to the minutiae of Karen's classroom and use classroom episodes to recognize the work that Karen enters into in as well as to highlight the complexities of caring both for students and for mathematics.

An ethic of care goes beyond smiles and hugs; it acknowledges the "complexity and the intellectual challenge of work with young children" (Goldstein, 1998, p. 245). Similarly, I examine the work of an educator through an ethic of care in order to better understand the teaching and learning of mathematics in an elementary classroom. Goldstein and her co-author Vickie Lake (2000), also consider the ways that teachers' experiences of and beliefs about care reverberate through their practice. They claim that teachers can "draw upon the pedagogical power of caring" (p. 863), through attending to their shaping influences, in order to sustain their challenging work with students. In my study, I also look back at my own experiences and beliefs about care as well as attending to Karen's life stories around care and the meanings they have in her classroom practice as she cares both for students and for ideas.

The power of care in the mathematics classroom is of particular interest to me. Amy Hackenberg, a professor of mathematics education, writes about one way to intertwine these two forms of caring: mathematical caring relations. Mathematical caring relations involve the learning both of students and of their teachers; they occur "in the context of aiming for mathematical acts of learning" (2005a, p. 45). Though such relations might be included within Noddings's ethic of care (Falkenberg, 2005), Hackenberg (2005c) prefers to use a model of mathematical caring relations to describe her way of working with her students. She agrees that there is a certain type of care in mathematics teaching and learning that is based on an ethic of care (that is, characterized by engrossment, reciprocity, motivational displacement, and movement toward an ethical ideal). However, she describes her receptivity as going beyond these characteristics to include "formulating inferences" (2005c, p. 30) about how students think about mathematical concepts and calling on "constructs regarding mathematical learning" (2005c, p. 30). Hackenberg argues that there is something essentially mathematical about the care in which she engages.

I like to describe this *something mathematical* as visualization in a broad sense: imagining possibility. Visualization is one way that these two forms of caring can overlap. As teacher, I visualize how my students think about mathematics and how they might react to my plans as I care for them. I also visualize mathematics concepts and how I might solve a particular problem. Hackenberg (2005a) describes mathematical carers as working "to harmonize themselves with and open new possibilities for students' mathematical thinking, while maintaining focus on students' feelings of depletion and stimulation that may accompany student-teacher interactions" (p. 47).

Hackenberg's work with Grade 6 students spurs me on to inquire about the relationships between care and mathematics in an elementary classroom (also Grade 6), while still holding the question of what the *something mathematical* might be in the context of care. The idea that mathematical caring relations might be a specific form of care causes me to ponder the connections amongst care, teaching, and learning. Though I do not think that care in the context of mathematics is essentially different from care in general or care in the context of another subject matter, some questions nonetheless arise. How might an ethic of care be realized in mathematics teaching and learning? How might an ethic of care be described more fully or even extended with respect to the mathematics classroom? These questions, though not my central research questions, live within the borders of this study and further elaborate my thinking leading to this study.

One way to think about care in the elementary classroom is to consider one of the characteristics of care, motivational displacement. In Noddings's descriptions, this shift in motivation is necessary to care and involves entering the cared-for's reality. Similarly, Hackenberg (in Hackenberg & Sinclair, 2007), writes of a "cognitive and emotional decentering" (p. 16) that is part of care. This shift, or decentering, consists of more than motivation. It involves intellectual and emotional work as the teacher imagines what the student might be thinking and feeling, and then plans accordingly. The characteristics that Noddings attaches to an ethic of care are often invoked by researchers, but are not always deeply explored. Through the contexts of teaching and learning mathematics, such as those described by Hackenberg and the one included in this study, an ethic of care in relation to mathematics teaching can be illuminated and complicated.

Hackenberg (2005a) also writes about tensions in caring. She reminds her reader of the difference between natural and ethical caring. Natural caring occurs when there are no inner conflicts in care. The carer acts because she wants to; her proclivity to care is realized. Ethical caring occurs when the carer "meets internal resistance to a belief that [she] should perform a caring act" (p. 48). Work is involved in ethical caring as the carer needs to put forth an effort to care. Hackenberg goes on to describe situations when ethical caring might happen: when the teacher is tired, when students are frustrated, or when the task of caring seems overwhelming. In all of these situations, the carer does not want to respond, but there is tension within the carer because she has an ethical ideal of herself as a carer; she has memories and a vision of what it is to care and be cared for. The care emerges not from a sense of obligation, but from a realization of the carer's own ethical self and a commitment to restore natural care.

The tension (or internal conflict) that Hackenberg describes is a reality for me as a teacher, but the tension between ethical and natural caring is not the focus of this study. When carrying out an ethic of care, a teacher "persists as mathematical carer in these situations because of [her] own memories and images of being mathematically cared for and of caring mathematically" (Hackenberg, 2005a, p. 49). The tension that I wish to study is not between natural and ethical caring. I recognize that the teacher may experience this internal conflict and will likely persist through it. Instead, I wish to study tensions arising between two forms of care: care for people and care for ideas. The tension is still within the teacher, but it is about how to attend to and enact care for students and for mathematics, not about whether or not to act.

Care in Social Work and Nursing

An ethic of care has guided research in a variety of educational contexts: teacher education (Lake, Jones, & Dagli, 2004), teacher identity (Vogt, 2002), gender constructions in school (Rodríguez, Peña, Fernández, & Viñuela, 2006), leadership (Kropiewnicki & Shapiro, 2001, April), and many curricular areas such as English (White, 2003), drama (Nicholson, 2002), and social studies (Jones, Pang, & Rodríguez, 2001). As Noddings is a former teacher and a noted philosopher in education, I expected (and found) a great deal of research on care and education. What I did not envisage was the abundance of research on care in other fields, especially social work and nursing.

As I described in the first chapter, social work holds a special place in my heart, as it was my father's profession for more than thirty years. Though he did not carry out research on care, he lived an ethic of care with his clients and colleagues. Many authors cite Noddings or use the word *care* in their titles, but two authors, Freedberg (1993) and Weick (2000), look to the history of care in social work and propose ways of expanding the notion of care there. In this study, I look backward to histories of care and forward to possibilities for care in classrooms.

As I was preparing my proposal for this study, I met de Sales Turner, a senior lecturer in the School of Nursing at Deakin University in Australia. I wanted to talk to her because of her research interests of hope, education, and nursing practices, as well as her use of photography and a narrative style. When she found out that I was exploring care, she provided me with a lengthy bibliography of care and nursing-related research[11]. Here I highlight two of these articles. Phillips (1993) addresses the use of the word *care* in health-related fields as well as connections amongst care, teaching, and nursing. I explore the etymology of the word *care* later in this chapter. Pearson, Robertson-Malt, Walsh, and Fitzgerald (2001) undertook a phenomenological study of nurses' experiences of working with the families of patients who are brain dead. I draw attention to this article both for the ethical issues involved in life and death and to point toward phenomenology, a part of my methodology, which I discuss in Chapter 3.

Critiques of Care

An ethic of care is part of my life, but for me it is also a topic of academic inquiry and a personal intellectual interest. An ethic of care offers much to me as a teacher and as a human being. In this study, I seek to describe care in Karen's elementary classroom and to expand notions of what it means to care as a teacher. However, I realize that the underlying ideas and assumptions of care should be continually re-examined and that they can be re-interpreted.

Though many critiques have been written about care, I focus on an article by Alisa Carse and Hilde Lindemann Nelson (1996) that outlines four problems associated with an ethic of care. I chose this article because it provides me with a summary of the main critiques of care and the authors turn to an ethic of care to search for ways to address the four problems. I treat each problem in turn by referring to Carse and Nelson's article and to other research.

Carse and Nelson describe the four problems as: "the problem of exploitation as it threatens care givers, the problem of sustaining care-giver integrity, the dangers of conceiving the mother-child dyad normatively as a paradigm for human relationships, and the problem of securing social justice on a broad scale among relative strangers" (p. 19). Carse and Nelson seriously consider each of these concerns, while concluding that the notion of care raises important ethical questions.

The first problem, of exploitation of the caregiver, stems from the close, intimate relationships on which an ethic of care is based. These relationships may for various reasons be unequal and unfair demands may be made on a caregiver.

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[11] I include research related to nursing because of the strong connections between care and health and also as a way of acknowledging the way the nurses in my family have influenced my life.

Feminist author and philosopher Sarah Lucia Hoagland (1990) points out that some caring relationships perpetuate dependent gender stereotypes and incomplete caring. Though I acknowledge that care can disintegrate into manipulation and abuse, I also find that an ethic of care calls us to go within and beyond ourselves so that we reflect deeply on our relationships with others. Carse and Nelson (1996) write about critically evaluating relationships through reciprocity: "Within a care ethic, a decent solution to the problem of exploitation will refer us both to an examination of the balance of relational goods exchanged by individuals (including affection, concern, humor, and the like) and to the broader structure of the relational networks in which we live" (p. 23). I do not mean to imply that we should "keep score" of our care, but that we should consider which relationships sustain and nurture care (for others and for ourselves).

The second problem, related to the first, is that of self-effacement. Critics point to receptivity and motivational displacement as being too other-directed, so that the carer surrenders his or her own values, ideas, thoughts, and self. However, as I read Noddings's work, self-care is at the very heart of caring for others; the two are inseparable. Carse and Nelson (1996) claim that an ethic of care "requires that we take the other person's perspective seriously, consider it openly, and understand its potentially important connection to her [*sic*] self-conception, even if we ultimately reject it. . . . An empathetic care taker must be able to survive as a strong, intact, self-respecting person" (p. 26). It is through a person's own care for him- or herself that he or she can begin to imagine the needs and motives of others. As I care for others, I return again and again to the well of self-care for inspiration and for nourishment.

The third problem is Noddings's use of the mother-child relationship as a basis for an ethic of care. Hoagland (1990) makes this point: "to the extent that the cared-for (child) cannot understand what the one-caring (mother) needs or wants, the conclusion I draw is that such a relationship is *ipso facto* a diminished caring relationship . . . an ethics [*sic*] of caring whose model is a dependency relationship that is ideally transitory provides at best for an incomplete analysis of caring" (p. 110). She goes on to say that "children learn to expect more one-caring—unidirectional—from all females" (p. 110). Others (such as Vandenberg, 1996) have also criticized the centrality of the mother-child relationship.

I do not see care as being based solely on the dyad of the mother and her child, nor do I think that parenting relationships are necessarily unidirectional. Though Noddings's (1984) examples are often of women and though her title refers to the feminine, she explains that care is based on human, not maternal, caring. She calls on the reader to recognize the masculine and feminine in each of us. In my own experience, related in Chapter 1, care is not exclusively the domain of women. Neither is parenting the only model of care, though it has inspired me in my caring for others. Noddings uses other models besides parents, including partners, spouses, siblings, friends, and colleagues.

Parenting relationships are nevertheless important. They may serve as our first models of caring for others. In caring for young children, there is little immediate reciprocity. One could describe this as *diminished* care. However, I think that parents feel the reciprocity of the caring relationship as they watch their children grow and thrive. Parents dwell in the possibility that in the future their children will care for others, including their parents. The parent receives something in the relationship, even if that something is as simple as eye contact or the prospect of seeing their child care for others.

The fourth problem described by critics of an ethic of care is the limitation of care to proximate others. Noddings (1984) describes care in terms of concentric circles, with our intimates in the closest circle. It is in the closest circles that it is most natural to care. However, if care is limited to these circles and not extended to strangers, it becomes narrow; "when all of morality is subsumed under the care we provide to our families, friends, and others in proximity, too much of the world is left out; we are too easily tempted to sexism, racism, xenophobia, homophobia, and disregard for future generations" (Carse & Nelson, 1996, p. 29). Carse and Nelson go on to say that "the ethic of care challenges us to resist the human tendency to remain blind and unconcerned about what is unfamiliar or more relationally and personally distant and to develop a sensitivity to differences in perspective and need as a demand of justice" (p. 30). Of the four problems, this is the one that I believe requires the most personal and community[12] commitment to puzzle out. The immediacy of those near and dear to us can be all-consuming.

Though there are other critics (and critiques) of care, I have included here those whom I see as the most important. Some of the questions that the critics raise are questions that I too have wondered about. Other points were new to me and made me think hard about what it really means to care. Although care cannot encompass all that there is to talk about in ethics, it is a stance in which I am confident. It has helped me to consider teaching with a broad view that is consistent with my personal experiences. Care goes far beyond my life. The idea of care has a history, which I explore in the next section. I then examine care in the context of mathematics.

Care and Philosophers

Martin Heidegger (1927/1967) wrote about care from an ontological perspective. As I understand Heidegger's treatment of the concept, care is intentionality rooted in experience; it is living mindfully. Care, then, is practical: it is part of the everydayness of life, the concerns of the world, and being open to the real people around us. Care is also theoretical: its concerns are of an existential nature, and it can be described as existential anxiety. Re-interpreted, care is what makes us human. This is the grandest of scales for considering care: to care is to be human and to be human is to care. But it is not enough to say that care is (part of) the human condition; it is a complex experience, with both tensions and congruities. What does care look like in an elementary school classroom? How is care connected to relationships amongst people and ideas?

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[12] Paul Smeyers (1999), an educator and philosopher, argues that an ethic of care can provide a framework for social justice through education.

An ancient fable, traced to the writer Hyginus in the first century AD (Grant, 1960), tells the story of Cura, the Latin feminine personification of care.

> Once when 'Care' was crossing a river, she saw some clay; she thoughtfully took up a piece and began to shape it. While she was meditating on what she had made, Jupiter came by. 'Care' asked him to give it spirit, and this he gladly granted. But when she wanted her name to be bestowed upon it, he forbade this, and demanded that it be given his name instead. While 'Care' and Jupiter were disputing, Earth arose and desired that her own name be conferred on the creature, since she had furnished it with part of her body. They asked Saturn to be their arbiter, and he made the following decision, which seemed a just one: 'Since you, Jupiter, have given its spirit, you shall receive that spirit at its death; and since you, Earth, have given its body, you shall receive its body. But since 'Care' first shaped this creature, she shall possess it as long as it lives. And because there is now a dispute among you as to its name, let it be called 'homo', for it is made out of humus (earth).' (F. Bücheler as cited in Heidegger, 1927/1967, p. 242)

According to this fable, care shapes our human existence. But what does this mean to a teacher of elementary school mathematics? How does care shape her practice, her interactions with students, and her pedagogical decisions? With human care as a backdrop, I am more interested in individual stories of care, particularly the stories of one elementary teacher.

Feminist philosophers, such as Joan Tronto and Eva Kittay, also emphasize care as a component of human life. Tronto (1993) proposes "an alternative view of care that integrates practical, moral, and political aspects" (p. 102). While recognizing the importance of interdependence that is clear in Noddings's work, Tronto expands on the private spheres that Noddings concentrates on in order to include public spheres[13] of caring. She explains that an ethic of care can help society shift from one fixated on dependence and autonomy to one that embraces personal and political interdependence. Kittay (2001) enlarges Noddings's idea of reciprocity to include "doulia" (p. 532), people to support carers who work in dependency relationships (such as teachers, nurses, and parents). Because the people who are the cared-fors in these dependency relationships cannot always reciprocate care, Kittay argues that society has a responsibility to "assure that care can be and is provided" (p. 535) for the carers by having doulia to reciprocate care when needed[14]. These two philosophers (and others) draw on and develop an ethic of care as described by Noddings; I follow their paths in basing my research on an ethic of care while seeing possibilities for extension.

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[13] Virginia Held (2006) makes similar arguments for considering care on a global scale.

Max van Manen, who conducts phenomenological research in education, writes about care-as-worry. Worry keeps us thinking about and close to the people we care for. Van Manen (2002) describes this preoccupation as "worrying mindfulness," "an affliction," "a chronic illness," and "being burdened by worries" (p. 265). In his collection of instances of care from literature and from life experience, van Manen emphasizes the "meanings embedded in lived relations of caring, not as we theorize caring but as we experience it before we conceptualize and abstract it" (p. 263). Though I have already begun to theorize care, especially care in classrooms, I have tried to follow his example to consider instances of care, or descriptions of care as I understand it.

Van Manen also explores the meaning of care in other languages. His linguistic exploration and the fable from Heidegger have prompted me to consider the etymological roots of *care*. Though the fable seems to point to the word *care* as having Latin roots, it actually comes from the Old English *caru* or *cearu*, which mean anxiety, sorrow, or care (Klein, 1971; Skeat, 1910). These are similar to the meanings van Manen explores. They point to tensions involved in care. Care is not easy; it has negative aspects that must be examined.

The sense of *care* that I use and the meaning of *care* in the fable have Latin roots, even if the word itself does not. The Latin word *cūra*, meaning "care, solicitude, concern" (Klein, 1971) or "care, attention" (Skeat, 1910), gives us the English word *cure*. Though *cure* and *care* sound alike, look alike, and have similar meanings, they do not come from the same roots. However, my use and meaning of the word *care* is closer to the roots of *cure* than to the roots of the word *care*.

I think it is worth exploring *cure* in the context of caring both for people and for ideas. Though *cure* is often associated with health and medicine, part of the meaning seems to fit with teaching. To cure a patient, a doctor might listen carefully, diagnose based on her or his education, training, and experience, and then prepare an appropriate plan of action. I see these actions as parallel to the work of a teacher. To care, a teacher might listen to a student, identify areas for growth based on the teacher's education and training, and prepare an appropriate lesson or task. The meaning of *cure* that I want to apply to teaching is not one of getting rid of a loathsome disease, but one of attending to and caring for people.

Two words related to cure, *curate* and *curator*, are derived from the Latin verb *cūrāre* and have this sense of care. A curate cares for people and their souls, while a curator cares for things, usually objects in a collection. These two words help me think about the forms of caring involved in teaching. Perhaps a teacher is both curate and curator, caring for people and for things (ideas). Both these words have the same etymological roots, just as caring for people and for ideas have the same genesis.

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[14] There are parallels between the care of a doulia and the supervision of psychotherapists (Whitman, Ryan, & Rubenstein, 2001).

Mathematics and Care

While my use of the words *care* and *caring* includes both an emotional aspect and an intellectual aspect, its main focus is an ethical stance. An ethic of care is a way of living, of teaching and learning, of considering dilemmas, and of working with others. It goes beyond helping, beyond being nice or polite. It requires intellectual work and is associated with emotional risk, just as studying mathematics involves work and risk.

Care involves entering into a relationship with another person or with ideas. A caring relationship between people is characterized by engrossment, motivational displacement, and movement toward an ethical ideal. Care is completed by response from the cared-for. The relationship need not be equal. The cared-for student may respond by engaging in conversation, making efforts at work that interests him or her, or sharing his or her ideas and plans. The teacher as carer cherishes these responses but does not demand them of the cared-for.

Rosemary Clarke (1988), a Gestalt psychotherapist and former teacher, describes this care as finding “ways of reaching that part in people that is *wanting* (to find out, to be loved, whatever)” (p. 171, italics in original). She gives an example of incomplete and complete care. In a teaching situation where the class is working on a concept (B) and a particular student has a beginning understanding (A) of the concept, if the teacher pushes the student “from A, where he [*sic*] is, to B where you are, he *must* resist. If, however, you go to A and be there with him and accept his worries or his excitement (whichever it is), he is then free to come to B of his own accord” (p. 180). There is possibility for reciprocity in care as the teacher receives the student where he is and the student responds by pursuing understanding with support. With pushing, the care is incomplete, but with motivational displacement and engrossment on the part of the teacher, the care can be completed as the student reciprocates care by working on the task. But what about care for ideas? How can care be completed with ideas, when there no possibility of reciprocity as there is in care for people? How are care for people and care for ideas the same? How are they different?

I think that care for ideas (such as mathematical ideas) grows out of the ethical ideal of care and into the intellectual domain. There are some similarities between caring for people and caring for ideas. Both may be characterized by engrossment. For example, I can become engrossed when solving a mathematical problem. I may spend hours and hours over many days trying different strategies. I may talk to others about the problem. I may even lie awake at night turning it over in my mind or wake early with thoughts of trying again. This engrossment may also be characterized by periods of receptivity, when I stop consciously thinking about the problem *per se*. I am open to ideas; in my mind I imagine a geometric object moving about as I do the dishes. If I do solve the problem (and sometimes even if I do not), I may experience a feeling of having received something, a sort of reciprocity. Perhaps it is an insight, a strategy, or a feeling of pleasure.

This reciprocity and engrossment can also be described as characteristics of encounter. Gladys Sterenberg (2006) describes relation as being enacted with the whole of a person's being: it is a "dialogic, reciprocal, mutual" (p. 18) encounter. She builds on the work of Martin Buber by claiming that mathematics is a being that can be encountered, even if it is an *it* and not a person. But the reciprocity involved in caring for ideas is different from the reciprocity involving people. Even if mathematics can be encountered, it cannot become the carer in a caring relationship, while people who encounter one another can choose to adopt the roles of carer and cared-for.

The characteristics of engrossment and reciprocity have parallels in caring for people. The attention and receptivity of the carer are sustained by the response of the cared-for. I think caring for ideas is rooted in experiences of caring for people. An ethic of care may serve as a model for other forms of intellectual care. Though my example of problem solving comes from mathematics, the characteristics of engrossment, motivational displacement, movement toward an ethical ideal, and reciprocity are also present as people care for ideas in other disciplines. But some aspects of care are of particular interest in mathematics. The aspects that I examine in Chapter 5 are indifference, mistakes, and conjecturing. These are but three of many instances of caring (or not caring) related to mathematics. My study considers the instances I have described in Karen's elementary classroom as well as a broader view of care as part of the way of life of Karen and her students.

In this chapter, I have described part of the academic terrain involving care. Many people, such as Noddings, Lampert, and Goldstein, have traversed this terrain before me. I imagine their scholarly paths crossing mine, for instance Hackenberg's work on care in the context of mathematics, and sometimes running parallel as with van Manen's phenomenological exploration of care. At times, I walk along their well-worn trails, taking heart from the marks they have left behind. Other paths I leave to others, using them to get my bearings and to acknowledge other routes to care, for example the critiques of feminist authors such as Hoagland. In the next chapter, I continue this walk along caring terrain as I re-consider my research questions: **How does a teacher in an elementary classroom care both for her students and for mathematical ideas? What are the complexities of caring both for students and for mathematical ideas? How are the complexities related to and shaped by the subject of mathematics?**

CHAPTER 3: A CARING APPROACH TO THE RESEARCH QUESTIONS

I come from a small town in New Brunswick called Grand-Sault, or Grand Falls. My mother grew up on a farm nearby, and her mother came from an even smaller town to the south called Johnville, an area settled by Irish immigrants in the mid-1800s. As part of a family reunion, my mother's family planned to take part in the annual Johnville Picnic[15]*, which consists of a town fair, a church lunch, and a parade where each family walks behind a banner of its own coat of arms.*

My cousins and I played Bingo, examined the preserves and crafts, and posed for photos in our matching T-shirts. Then it was time for the parade. We lined up behind the Mahoney banner. As we began to move forward, we looked around for the spectators. A few elderly residents, unable to walk, sat in lawn chairs on the side of the road. We kept walking, watching for the crowd, waiting to wave and smile. Then we realized that everyone was in the parade. No one was watching. We were both paraders and spectators as the parade line looped back onto itself.

This parade story has become for me a metaphor for research. I am part of the research and I am also attending to others who have chosen to be part of the research, like Karen and her Grade 6 students (for more on parades, see Clandinin & Connelly, 2000, p. 81). My experience of the parade/research depends on my point of view, my position in the line, the companions walking with me, the rise and fall of the landscape, and the banner I choose to walk behind. For this study, I have chosen my primary banner: *care*. Some of my companions are already with me as I prepare for the parade/research: my family and friends, other researchers (and their writing), my colleagues, and the members of my supervisory committee. There is already reciprocity as we are spectators and paraders for one another. Before I enter the parade I have to make some choices. I will make other choices as I proceed along the route. In this chapter, I frame my point of view, explain how I came to join my research companions in their parade(s), and describe some of the landscapes we walked across together.

Case Study

As I began to think about what sorts of methods would be in keeping with my research questions, I considered what approach to the research would also be consistent with who I am and what interests me, as well as what approach/es would be meaningful and attend to the voices of my participants. A qualitative case study is an appropriate choice for describing the phenomenon of care in the mathematics classroom. According to Merriam (1998), a case must be "intrinsically bounded" (p. 27). In my study, the case is one teacher, Karen, and her class of Grade 6 students; the boundaries are the specific classroom and school. The idea of boundaries helps me keep the research questions in mind. I am primarily interested in how Karen cares both for her students and for mathematics; this is the focus of my research. The boundaries, though permeable in the sense that the world outside the school is part of what happens in the classroom, help to frame and direct my attention.

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[15] The 130th Johnville Picnic will take place in the summer of 2008.

My research questions fit nicely with the goal of a qualitative case study: understanding (Anderson & Arsenault, 2000). My central research questions are:

- **How does a teacher in an elementary classroom care both for her students and for mathematical ideas?**
- **What are the complexities of caring both for students and for mathematical ideas?**
- **How are the complexities related to and shaped by the subject of mathematics?**

In particular, I am interested in understanding how Karen Marks cares for her Grade 6 students and for the mathematical subject matter they encounter together. Merriam (1998) writes: "case study design is employed to gain an in-depth understanding of the situation and meaning for those involved" (p. 19). Understanding care in Karen's classroom has to do with *who* the people are, *what* the subject matter is, and the interplay between the people and the subject matter. A case study is broad enough to consider these ideas while still being focused.

A case study can be descriptive and contextual. These features are important in responding to my research questions and in working with Karen and her students. I seek to tell a story about what it is for Karen to care, at the same time, for her students and for the mathematics they encounter together. Though I entered Karen's classroom with the idea of illuminating care through the understandings I would develop by working alongside her and her students, I also remained open to other possibilities that could emerge. I chose to describe both the happenings in the classroom and the context of the lives of Karen and her students because both of these shape the care that develops between Karen and her students.

A case study "can illustrate the complexities of a situation" (Merriam, 1998, p. 14). As I described in my anecdotes, care can be problematic. Even when it is easy to care, the care is connected to previous experiences, hopes, relationships with others, and more. Care is truly complex. A case study is one approach where these complexities can be central to the research.

Case studies have no predetermined methods. Rather, methods are selected to suit the research questions. With my questions in mind, my research draws on two important traditions in educational research: narrative inquiry and phenomenology. Though I call my study neither a narrative inquiry nor a phenomenological study, aspects of these two traditions have profoundly influenced my thinking, my actions, and this research text.

I began this chapter with a story of walking in a parade. I continue with the metaphor of walking as research. Throughout my doctoral journey, I have been walking. My husband, Patrick, uses our car to get to his workplace because are no transit links. I walk everywhere: to the bus stop, the pharmacy, and the grocery store; around our neighbourhood as a form of exercise; and in a nearby park to soak up the beauty and quiet. Putting one foot in front of the other is a wonderful way to get to know a landscape, to attend to details in the environment, and to have a good talk with someone.

In my research, I also have been walking figuratively (sometimes very, very slowly) in two worlds: a phenomenological world and a narrative world. Using a case study approach gave me the space to walk *care*-fully in both of those worlds. In each world, I attend differently to aspects of care. My gait changes slightly, my noticing shifts, and the texture of my writing is altered. Though I do not think that the two worlds I walk in are mutually exclusive, each has a special atmosphere or way of seeing that I describe in the next sections.

Walking in a World of Phenomenology

In the phenomenological world, I attend to the idea, or phenomenon, of care. I ponder meanings, experiences, and images of care. Seeing the word *care* in a novel can make me pause in my reading and think about what the author or the characters mean. As I walk through the world, I see caring (and sometimes not caring) everywhere: in the grocery store, in my kitchen, at the university, and among family, friends, and strangers. But it is in the classroom that the phenomenon of care seems most textured and most complex. It is both as a researcher and a teacher that I ask my research questions.

Phenomenology, as described by van Manen, is an educational research tradition that resonates in harmony with the characteristics of care outlined by Noddings:

> Especially where I meet the other person in his or her weakness, vulnerability or innocence, I experience the undeniable presence of loving responsibility: a child who calls upon me may claim me in a way that leaves me no choice. Most parents have experienced this moral claim and many teachers and other educators who are involved in pedagogic relationships in a self-forgetful manner have experienced this effect of children in their lives. When I love a person (a child or adult) I want to know what contributes toward the good of that person. So the principle that guides my actions is a sense of the pedagogic Good . . . at the same time I remain sensitive to the uniqueness of the person in this particular situation. (van Manen, 1997, p. 6)

This passage about phenomenology and pedagogy reminds me of the response, reciprocity, motivational displacement, engrossment, and movement toward an ethical ideal involved in care. There can be an intimate and caring connection between teacher and student that is similar to a parent-child relationship. In van Manen's words, there is a sense of caring both for the particular child and for the more general good. This sense is closely aligned with my research questions about how a teacher cares both for students (unique individuals) and for subject matter (general pedagogic ideas).

The tradition of phenomenology has helped me to prepare for research alongside Karen and her students. Van Manen (1997) writes: "Phenomenology aims at gaining a deeper understanding of the nature or meaning of our everyday experiences" (p. 9). Care is an everyday experience for me. It is an integral part of my lived experience as a teacher. Before I entered their classroom, I walked towards Karen and her students, taking slow, thoughtful steps. Using some of the orientations of phenomenology, I began to reflect on care as part of the research process.

One of these orientations is attention to language. As an avid reader and bilingual speaker and teacher, language is one of my life-long interests. In Chapters 1 and 2, I explore idiomatic phrases involving *care* and the etymological roots of *care*. This exploration has helped me to develop sensitivities to care. Van Manen (1997) also looks briefly at the word *care*. He comments, "retrieving or recalling the essence of caring is not a matter of simple etymological analysis or explication of the usage of the word. Rather, it is the reconstruction of a way of life: a willingness to live the language of our lives more deeply, to become more truly who we are when we refer to ourselves, for example, as teachers and parents" (p. 59). As I walked with Karen and her students, I came to a deeper living and understanding of care and its language in relation to parenting and teaching. I now use the word *care* with power and with roots. I think deliberately about care in my everyday and academic lives. In keeping with the phenomenological tradition (van Manen, 1984), I do not seek definitive answers to my research questions, but ways (such as through attention to language) to consider care as a common human experience *through* my research questions.

Though I began with my own lived experiences of care (a second phenomenological orientation), I am interested in how a teacher in an elementary classroom cares both for students and for mathematics. The phenomenological tradition presupposes personal engagement. By reflecting on my memories of caring, writing anecdotes around care, and exploring my stories of care, I began to search for meanings of care and to formulate my research questions. When I set out on this long walk, I was no longer a classroom teacher. As I reflected on my experiences and delved into the roots of care, I thought about a teacher I knew, Karen. Having heard her tell stories of her classroom and of the work she and her students did together, I knew that she cared deeply for her students and for mathematics. Mutual acquaintances who had been in her classroom had told me informally about the caring atmosphere they had observed. I knew that Karen was living my research questions with her students. After I obtained ethical permission from the University of Alberta and from Karen's school district, I contacted her and invited her to be a participant in this study.

A third orientation of phenomenological research is: "to 'borrow' other people's experiences and their reflections on their experiences in order to better be able to come to an understanding of the deeper meaning or significance of an aspect of human experience, in the context of the whole of human experience" (van Manen, 1997, p. 62). Through our conversations and writing together, I sought to understand care through Karen's eyes. I *borrowed* her experiences. Walking alongside Karen and her students has helped me to get a feel for the landscape of care as a human experience, but also as part of their particular, individual lives.

In phenomenology, one way to bring the phenomenon to the fore is through writing, a fourth orientation with which I worked. Karen and I wrote frequently with one another about experiences of care from her classroom. To frame this writing, I use the work of John Mason (2002), a mathematics professor and educator, who describes writing accounts as part of "noticing." Though Mason does not situate himself in the phenomenological tradition, I see many similarities between his "discipline of noticing" (2002, p. 59) and some of the orientations of phenomenology.

Mason's discipline of noticing has its roots in problem solving. In one of his earlier works, *Thinking Mathematically* (Mason, Burton, & Stacey, 1985), the reader is encouraged to notice and become aware of his or her problem solving strategies and emotions. The reader can draw on these sensitivities in future problem solving experiences. The discipline of noticing is centred on developing sensitivities for attending to aspects of practice that may be unexamined and habitual, such as care involving people and ideas.

Writing *accounts-of* classroom moments is one way to develop these sensitivities. The process of writing an account-of distils a moment of practice into a brief-but-vivid description. Mason differentiates between giving an *account-of* and *accounting-for* an experience. Accounting-*for* an experience includes explanations, judgments, and evaluations surrounding an event, while an account-*of* minimizes these aspects. The idea is to write up the account-of so that others who were present (or not) recognize the experience and so that the experience resonates with their own experiences.

Mason (2002) writes that collecting these accounts-of "is one step towards . . . identifying a type of situation, tension, issue or interaction which is exemplified in several different incidents or experiences" (p. 41). Karen and I wrote such accounts[16] as we sat next to one another in a quiet area of the school. We spent a few minutes identifying an experience of interest from the previous week and talking about the episode. I usually asked Karen what moment or moments she had noticed, but I also had in mind a moment that I thought was related to care. We both wrote about the same episode and then read our accounts to one another. We talked first about the accounts, and then our conversations expanded to include other topics, stories, and musings. The accounts also became fodder for further exploration, which I describe in Chapter 5.

As an example here, I share excerpts from an account of one classroom moment. These were the first accounts we wrote. I was still getting to know Karen and her students, and Karen was still getting used to me being in her classroom. There is something in these accounts that I think many teachers will recognize, perhaps it is the underlying tensions about sharing student work or the pedagogical thinking that Karen describes.

> Julie: *Yesterday, Karen put the work of two students on the screen at the front through the computer and digital projector. The worksheets were about surface area. Students had determined the surface area of different boxes. The names of the two students had been removed from the worksheet. Karen asked the students in the class to look carefully at the work from a teacher's point of view. Someone asked if it was the work of people in the class. Karen said yes. There were a few whispers and some pointing as they tried to figure out who the work belonged to. Kasey glanced at Alex and smiled. Karen asked students to concentrate on the mathematics of surface area and they shared what could be improved in the communication and what was effective. Karen pointed out some of the aspects (such as diagrams) that helped her, as a reader, understand the person's thinking.*
>
> Karen: *Yesterday, I shared two samples of student work with the class. We've been looking at surface area, and the activity involved estimating, then calculating the surface area of a box chosen from a variety of boxes. I'm trying to encourage better recording of ideas during math activities – we tend to get so caught up in the "doing" that we neglect the recording. I often find that my pacing is off, and I don't allow time for that part of the lesson.*
>
> *I chose two pieces of work that both had some strengths, but also some areas that might be improved. I showed them on the screen, without the names, and tried to get the kids thinking about what worked well as well as what could be improved.*

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[16] Since the accounts that Karen and I wrote include elements of *accounts-of* and *accounts-for*, I use the general term *accounts* to describe our work.

> *Right away, it was obvious that what the students were most interested in was whose papers were being shown, and this distracted them from thinking about the math. I tried to redirect them, but I'm not sure how successful that was.*

If I were to give this classroom moment a title, it might be "A person's work vs. the work as mathematics," "Naming matters," "Teacher intentions and student priorities," or "Whodunit?" There is care in this moment as Karen invites her students to engage in mathematical and critical thinking while realizing that they are more interested in the people behind the work. She cares for the people whose names she has removed from the pages by deflecting direct criticism of their work and continuing not to name them.

These excerpts contain elements of an account-of and of an accounting-for. Because care is complex, it was not necessary to separate the experience from the context. Often the explanations Karen offered around a particular episode were related as much to the research questions as to the episode itself. Again and again, these explanations led to rich conversations.

I wrote and shared with students short fictional accounts based on my experiences as an elementary teacher. At the end of the school year, I audio-recorded interviews with students (sometimes individually, sometimes in groups) about care. I provided four accounts[17] as a way of stimulating and focusing these conversations. Though Karen is of principal interest in this particular study, I was also interested in her students' insights and thoughts about care in the mathematics classroom because they had caring relationships with Karen and with one another. Though I only draw lightly on the interview transcripts in this dissertation, the students' understandings became part of my writing about profound attention, which appears in Chapter 4.

As I walk in a phenomenological world, I attend to care as an everyday, significant human experience. I am oriented towards the language and broad meanings of care in the classroom, as experienced by Karen and her students. Much of my phenomenological trek took place in preparation for my research in the classroom, though I maintained many phenomenological orientations as the case study unfolded. As I began to think about walking alongside Karen (and, later, alongside her students), my gait shifted.

Walking in a World of Narrative Inquiry

In a narrative world, I attend to the stories that Karen and her students tell and live out in the school and on the playground, especially stories related to care. A three-dimensional narrative inquiry space, as described by D. Jean Clandinin and F. Michael Connelly (2000), has helped me to think about how Karen and her students care both for one another and for mathematics. The three dimensions include interaction, continuity, and place. These dimensions helped me to create field notes.

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[17] See Appendix A.

> *Having driven Patrick to work, I now sit in the car in a line of parked vehicles outside the school. I feel a bit nauseous. My hands and feet are cold and my cheeks are warm. I call Patrick on the cell phone to check in. I tell him that I am nervous about beginnings; they are important. They set the tone, they frame what is yet to come. When I hear the bell ring, I notice parents spilling out of their vehicles and climbing over the snow bank, waving to their children as they come out of the building. I wait a few moments, taking deep breaths and mentally reminding myself about the things I'd like to talk to Karen about. I think about what it might be like for her to have a 'researcher' coming to her class, interested in her practice. I consider that she might be nervous too.*
>
> *I climb out of the vehicle and over the snow bank. I ask a parent passing by to direct me to the office. As I step toward the school door, I pay little attention to the building, instead I am focused on the young people around: three adolescent boys rough-housing near the corner, younger children with backpacks running to the nearby bus.*
>
> *As I go in the door and step on a thick mat, I see a man with a mug in his hands stepping out of the main office. I introduce myself and asked where I can find Karen. He directs me to her classroom, last one on the right at the end of the main hall. I wait for a minute or two on the mat, giving Karen and her students time to make their end of the day preparations. Children stream by me, holding their boots in their hands until they make it to the mat. Their faces are smiling. I think to myself that I am a minority with my very light skin. I notice a sign asking visitors to remove their boots and I do so before moving down the hallway. I hear teachers speaking a language I do not know as I walk by quietly in my sock feet.*
>
> *As I enter Karen's classroom, I see her talking with a student near her desk at the side of the class. Another girl is kneeling next to her student desk organizing her things. I linger by the door and look at the walls. They are covered. There are signs about respect and responsibility. There are language arts reminders near the light switch.*
>
> *As Karen and I began to talk, we discuss the classroom and the school. I note the projector hanging down from the ceiling as well as the microphone around Karen's neck. The cabinets look new, but there is a sense that the school had been around for a number of years. Karen tells me that the school has been recently renovated, which accounts for the new floors, technological equipment, and the sink at the back of the*

> *classroom. But the doorframe bears traces of the entrance and exit of many people, with the green paint chipping.*

In this field note excerpt from my first of meeting with Karen to discuss the possibility of working alongside her and her Grade 6 students, the three dimensions of interaction, continuity, and place are already important. As I attend to my emotions, think about how Karen might be feeling, and notice the cultural and language richness of the staff and students, interaction is at the fore. Within interaction, there is a strong element of relational care, especially as I draw on my feelings to help me to imagine Karen's feelings and to prepare myself to be sensitive and responsive. I am careful not to interrupt Karen's conversation with her student as I enter the classroom and loiter near the door. Respecting Karen's interactions with her students has been important from the beginning. As we talk about the history of the school, get caught up on our lives since we last saw one another, and make plans for the future, the continuity of past, present, and future comes alive. As I focus on the classroom space and try to follow the school routines and rhythms of Karen's teaching day, the physical and contextual place is central.

Karen, her students, and I got to know one another better over the months that followed. My relationships with them became essential to my research and to my life. After Karen welcomed me and we began to negotiate what it would mean for me to do research with her and her students, I came to the classroom during the school day to introduce myself to the students and to explain why I was there. As Clandinin and Connelly (2000) describe it, I began research "in the midst" (p. 63) of my own life and the lives of my research participants, Karen and her students. My first research day was also the day my twin niece and nephew were born.

> *Karen and I walk back to the classroom. On the way, she mentions that there were 'girl' problems in the classroom. She says that she is concerned about how some of the girls were treating one another. She shows me where I can stow my coat and boots. She makes a space for me at a table at the back where I can sit and take notes. We talk a bit about how the morning will run and what my role will be. Karen also tells me about the students, especially the ones she is concerned about. She talks about how she really thought hard about what groups to put the students in. She changes their desk arrangements every week (on Friday). Last Friday was been hectic with the multi-age activities celebrating a cultural event. Monday was a holiday. Yesterday (Tuesday), the students had a substitute teacher and Karen is worried about how the group members worked together. The students helped to organize themselves in groups.*
>
> *When the students come in at the bell, they leave their coats and boots in the hallway and come into the classroom to put on their indoor shoes. A few smile at me when I say good morning, glancing over at the board to see what the schedule is for the day. My name is on the schedule, followed*

> *by Math (Intro to Area), class meeting, and Science (Crime Scene Investigation).*
>
> *The morning class starts as Karen shows the students a belated Valentine from their former music teacher and then a second one from another teacher. Then, Karen introduces me to the class as Ms. Long (teachers go by last names here). I speak for a few minutes while Karen takes care of attendance. I tell them a little about the project (how it is not a test and will not affect their grades) and what I will be doing (notes, pictures, recordings) and why. I identify myself as a student, like them. I tell them that I think they are all good learners and that I think their teacher is fantastic and that's why I wanted to come work with them. I say that I will also be helping out in the classroom. I speak a little about the information letters and consent forms. While I am speaking, students begin reading the announcements over the intercom. When they finish, Karen asks if anyone has a circle to show the class. She draws three large circles on the board with lines going through them, the beginning of a task on number patterns.*
>
> *[Later in the day], Karen invites us all to the carpet. Together, they talk about the various materials for the task they just completed and which worked best for measuring area as well as which shape has the greatest area. While we are on the carpet, I notice that my phone is vibrating and I ache to answer it to see if the babies are born. Karen then introduces a third task on a blue paper. There are three pairs of rectangles and students are asked to find out which rectangle of each pair has a greater area. Karen asks them to estimate first and to write their estimates down. They then have to make their decisions without using the materials or rulers. They are allowed to cut the shapes out and compare directly. Students use various strategies including measuring with their fingers, cutting and overlapping as well as folding into the same number of pieces and comparing the size of the pieces. Karen reminds students to write down how they know one rectangle is larger than the other, if it isn't directly observable from their other work on the page. At this point, I am sitting in Renee's place with Emily and Sophie. After the reminder from Karen, they reconfigure one of their answers with more cutting and pasting. Sophie tells me about intramural floor hockey. Her team is playing Kasey's team and she is excited.*

My field notes are peppered with what Karen Hale Hankins (1998) describes as "'headnotes' — mental notes — 'hard notes' — direct observations — and 'heartnotes' — my feelings and reflections" (p. 83). These head, hard, and heart notes are the interwoven threads that make up my field notes from this very first research day through to the very last one. Though at times I tried to separate the three kinds of notes by writing reflections, or heartnotes, on readings and on ideas that I had been thinking about, the three were usually so tightly intertwined that I did not know where one kind began and the others ended.

After the first encounters with Karen and her students, I was in their classroom almost every day, following Karen's half-time teaching schedule. I was present for all of the students' mathematics classes. This provided me time to write daily field notes, organize field texts, reflect on classroom events, and continue academic reading. In order to bring the texture of the classroom relations alive, I wrote in great detail and included pictures of Karen, the students, and their work together. Sometimes it took me as much time to write the notes as it did to observe the events in the classroom. I continued to imagine a three-dimensional narrative inquiry space. There is a sense of interaction, of looking inward and outward as I think about the babies about to be born, listen to Karen's worries about some of the girls, and acknowledge Sophie's excitement about her floor hockey game. I look backward and forward in time as I attend to what has happened before my arrival and talk about the future in the context of the research project with the students. And the place is ever-present as I begin to notice how Karen and her students go about their day with one another.

I was with Karen and her students for four months. I began research in Karen's classroom in late February and continued until the end of the school year. Most weeks, I was in the classroom for three half-days (Tuesday afternoon, Wednesday morning, and Thursday afternoon) and one full day (Friday). These were my *research days*. On Wednesdays, Karen and I both stayed at the school in the afternoon, using this time for our research conversations and writing. I wanted to be with Karen and her students as much as possible so that I could know them deeply and understand how they cared for one another and for mathematics. At the same time, I sought to be respectful of the lives they were already living in the school. I checked with Karen often to make sure that my continued presence was a good fit for her and for her students.

We adjusted our work with one another in the classroom as I participated more actively with students in their learning. Taking my cues from Karen, I circulated amongst groups, asking questions, observing, listening, and responding to questions. Sometimes I worked with individual students on particular tasks when Karen asked me to, when a student was working alone near me, or when a student approached me. I also interacted in a more social atmosphere with students during lunchtime in the classroom or at Lego Club. In all of these interactions, I tried to establish and maintain caring relationships, not as a research goal, but as a way of being with them that is consistent with who I am. Attention to the *I,* the person I have been, the person I am now, and the person I am becoming, as well as to the connections between Karen, the students, and me are part of what it means for me to walk in a narrative world.

Early in the research process, Karen told me that Wednesday afternoons would be a good time to meet and talk about all that had happened in the preceding week. These Wednesdays became special to us and to Karen's students, as Karen allowed them to eat their lunches in the classroom and to play on the computers as a weekly treat. On other days the students ate all together at foldout tables in the gymnasium.

After lunch, Karen and I met in the staff room to finish eating and to make tea to drink during our conversations. These conversations took place in the photocopy room, the staff room, or the library. At the beginning, we often wrote accounts of an episode that had happened since the preceding Wednesday. We first chatted briefly about the events of the past week and chose one episode that was of interest to both of us and that related to care. Then, sitting side by side, we each wrote an account, read them out loud to one another, and then discussed them in more depth. We talked about many topics, sometimes returning to the same story threads again and again. I audio-recorded all of our conversations and later had them transcribed. These conversations became one of many types of field text (for more on field texts, see Clandinin & Connelly, 2000, Chapter 7).

The composition of field texts is another area in which narrative inquiry informed my study. In addition to the field notes, occasional reflections, and co-composed conversations and accounts, I composed other field texts such as letters to Karen, photos not included in the field notes, sketches, memory aids such as a weekly calendar of events, and recorded-then-transcribed interviews with students. I also gathered some of the documents that Karen used in her teaching; I asked her to make an extra copy of each sheet she handed to students. I included items that students gave to me, such as cards and drawings. Though I started my study with the idea that accounts, conversations, and field notes would be important, I came to find that other compositions were helpful as memories from my life drifted into consciousness, as connections arose with the reading I was doing, and as I sought to continually find meanings for care in Karen's classroom.

And so my research days passed as I sometimes listened, wrote, and took pictures, sometimes worked with students, sometimes played Lego, and sometimes sat quietly nearby. Each day was different, yet shaped by familiar rhythms and routines. I got to know Karen and each student and I looked forward to walking with them every research day.

After I left the classroom in June, I continued to walk with Karen and her students as I composed interim texts from the field texts. There were so many field texts that I had to create a way to explore them in their entirety while thinking about what it meant for Karen to care both for her students and for mathematics. I looked through each document, underlining and circling passages that seemed important. I wrote notes to myself in the margins. Using an artist's sketchbook, I recorded direct passages in pencil and my notes in pen. I added arrows and lines, circled names, ideas, and words, underlined, wrote in different shapes, and sketched. In the sketchbook I noted the date of each document thus re-interpreted. Sometimes one document took several pages to render, while other sketchbook pages incorporated several documents. Throughout the process, I often looked up to the wall where I had posted my research questions. Each field text, each note, and each page in the sketchbook became a way of considering my questions within the context of Karen's classroom. I thought about how Karen cares both for her students and for mathematical ideas in their classroom. I puzzled about the complexities of caring both for people and for ideas as well as how those complexities might be related to and shaped by the subject of mathematics.

As I slowly walked with Karen and her students in the classroom and as I walked with the field texts, the intentions that I had laid out in my proposal for this study began to shift subtly. I surprised myself at what I was writing about when I began to compose research texts. The interim texts reminded me again and again of the complexity of care, of the intertwining of my life with the lives of Karen and her students, and of the role of mathematical subject matter in this study. I walked even more slowly and with uncertain steps as I composed a variety of research texts.

The research texts in the following chapters are informed by narrative inquiry. I pay attention to a three-dimensional inquiry space, to the *I* in this research, and to the stories of care that Karen and her students share and live out at school. Under the surface of the texts runs the theme of the care and response of many people. As I wrote the research texts, I read them aloud, shared written passages, listened to what others had to say, and re-shaped the texts again and again. Karen and I took turns reading aloud from the research texts and entered into conversation in the spaces between the words. Sharing my writing-in-progress with Karen was one way to attend to my "relational responsibilities" (Clandinin & Connelly, 2000, p. 176) toward my participant. Through the reading and discussion, Karen and I were able to hear the written words and discuss whether they resonated with our experiences and identities. New topics of conversation often emerged when we shared the texts, spurring further thinking and exploration. Members of my supervisory committee also read and responded to my writing on a regular basis. They also offered on-going feedback and discussion in many informal encounters (in the hallway, via e-mail, over the phone). My parents, who were central to the genesis of this study, also read some texts and talked with me about them. I attended a weekly conversation about research issues where I occasionally read or wondered aloud about how to proceed with my writing. Response, as part of care, is also an integral part of walking in a world of narrative inquiry.

Ethical Considerations

Though I place this section near the end of the chapter, it is not an afterthought. Ethics are the foundation of this study. I have already described in detail Noddings's ethic of care. An ethic of care permeates this research, but I would like to elaborate on other ethical issues related to this study.

David Flinders (1992) writes about protecting human participants involved in qualitative research. He describes four ethical frameworks to consider: utilitarian, deontological, relational, and ecological. The utilitarian prototype has to do with traditional notions of ethical standards such as "informed consent, avoidance of harm, and confidentiality" (1992, p. 102). In keeping with these longstanding ethical standards and the ethics regulations of the University of Alberta, I sought to: minimize harm, obtain fully informed consent, protect privacy and confidentiality, and remove deception on my part (Lincoln & Guba, 2003). I talked with Karen and students about the study, especially about consent, anonymity, confidentiality, and opting out. I provided letters of consent[18] at the beginning of the study and image release forms[19] at the end. The transcriber who worked for me signed a confidentiality agreement[20].

The deontological framework focuses on reciprocity and a sense of fairness. The etymological roots of deontology have to do with obligation and duty[21]. This framework recognizes that the participants are *active* participants in research and that researchers have obligations to the people involved and not only to the research goals and the ethical standards of the university. It was especially important for me to consider power relationships are as I was a guest in a classroom and in a school. I tried to stay awake to my position in relation to Karen and her students. I offered research reciprocity that I thought was fitting to the context, such as classroom help, supervision of students during Lego and other activities, and technical support in a school project. In the spirit of fairness (and care), I shared my research texts with Karen as works-in-progress.

Relational ethics, Flinders's third framework, is explicitly based on the work of Gilligan (1982) and Noddings (1984). In the spirit of care, I sought to be "present, attentive, and fully engaged as a co-member of the participants' immediate community" (Flinders, 1992, p. 107). I tried to be receptive, to pay profound attention to Karen and her students, and to confirm them by attributing to them the best possible motives in my field texts and research texts.

An ecological framework focuses on the cultural features of the classroom and the interrelationships among the participants, including myself. One way to attend to the culture is to focus on language, as I did in writing the first two chapters of this text and as I composed, co-composed, and gathered field texts. I attended to and became sensitive to patterns that were part of the culture of the classroom and the school. This included considering the subject matter: mathematics. It was both necessary and meaningful for me to attend to Karen's and her students' ways of engaging with mathematics, to the culture they have formed around mathematics, and to the larger mathematical community.

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[18] See Appendix B.
[19] See Appendix C.
[20] See Appendix D.
[21] According to the Oxford English Dictionary, the roots are from the Greek *deon* "that which is binding" and *logos* "discourse" (Simpson, 2008).

All four of the frameworks described by Flinders inform this study. Though the descriptions do not provide solutions for all ethical dilemmas, they helped me to set a path for the study and for my thinking and actions. Throughout this study, relational ways of being with Karen and her students were of primary importance. I thought of each of them as individuals, but also as connected to others, to each other, and to me. I tried to be present alongside them so that we walked together as storied, connected, becoming, and knowing selves.

I drew on these frameworks a few times during the study to negotiate challenging ethical situations. Two of those situations, the death of a staff member and the relationship between Karen and her own daughter (not a student in the class), are central to Chapter 4.

When Karen told me about the death of her colleague, I decided to stop taking notes in class for several days, though I still wrote up field notes at home. It was not difficult for me to decide to place my research goals on hold, making them secondary to supporting Karen and her students through a tough time. I offered to stay with her and the students or to provide support in other ways outside the classroom, as Karen saw fit. I offered my listening ears and, occasionally, hugs and tears. In the days that followed the announcement of the teacher's death, care (or relational ethics) was central to my actions. I also felt a sense of duty (deontological ethics) to Karen and to the other teachers in the school; I offered my time so that one of them could be released from their teaching duties to attend the funeral. I worried that including this event in my research might connect Karen with a particular school. I shared this concern with Karen, offering to remove references to the event, but Karen declined this offer and wanted the event to be included. I was careful about not identifying the school or the school district in order to protect anonymity and confidentiality.

Karen's relationship with her daughter was an important part of her care as a teacher. Since there were some personal aspects to this parental care, I shared my writing-in-progress with Karen, who in turn shared it with her daughter. I offered to make changes or to remove parts that made either of them uncomfortable. As a way of recognizing the importance of their relationship, I asked Karen to choose their pseudonyms.

A third ethical challenge caused me to draw on Flinders's four frameworks: not all of the students participated in the study. Though I had obtained ethical clearance from the school district, from the administration of the school, and from Karen, I also sought the consent of the students and their parents or guardians. Some parents/guardians did not give consent for their children to be participants. For the students who did not participate in the research, I continued to act as a classroom helper, but I did not use our conversations or my relationship with them as part of this dissertation. It was important to me that the both the students who participated and those who did not were able to receive my academic help. I tried to remain receptive to all the students as a caring adult person in their classroom.

At the end of the school year, I did not interview the students who did not participate.

An ethic of care permeates this study. In a sense, care is the theoretical framework, the topic of study, and part of the ethical framework for the research. I look *at* care, as well as *through* a lens of care *with* caring intentions. Though it is not an explicit part of the methodology of this study, an ethic of care influenced my conduct and choices in the classroom. For example, my orientation towards care directed my attention and shaped my field texts. This orientation also affected the way I approached and worked with Karen and her students as I strove to attend thoughtfully and to make my goals subordinate when necessary. The focus on care moulded my views of myself as researcher in the classroom and made me think about how to undertake (and continue to carry out) a study *about* care *with* care. I drew on my ethical ideal and views of my ethical self to be a caring participant-observer in the classroom.

Through this description of the methodological framework of case study, the influences of phenomenology and narrative inquiry, and ethical considerations, I have retrospectively mapped the terrain that I walked before and during my time in Karen's classroom. In the chapters that follow, I walk a little farther by returning to the various field texts with care and by writing more deeply about how Karen cares both for her Grade 6 students and for the mathematical subject matter they engage in together.

CHAPTER 4: A DAY IN THE LIFE OF KAREN'S CLASSROOM

It is a Friday morning, early. Karen is sitting at her computer near the window. The lights are off, but the spring sun is peeking through the slits between the vertical blinds. The halls are quiet, though the backpacks hanging in the hallway across from the classroom are hints that students have snuck in and out quickly. Karen is catching up on some e-mail before heading out for supervision.

The playground is muddy at the edges where the grass meets the pavement. A group of boys is gathered around a murky puddle, taking turns walking across it, getting their feet wet. With a smile on her face, Karen strides over and asks them to play elsewhere, pointing at their soaking sneakers. They grin and move toward the soccer field. She spends the rest of her supervision time chatting with Mariah, Hannah, and Katie from her Grade 6 class and takes her turn throwing a football with Nicholas, Alex, and Aidan. She throws with a spin the boys admire.

At the bell, Sophie and Anne drag a large orange pylon into the school. As school patrollers, they wear safety vests and carry stop signs. They help people cross the street on the way to and from school. As Karen unlocks the door to the classroom, Sophie, who has freckles and long, thick braids, tells me excitedly about her soccer team's winning streak as Anne animatedly describes her plans for the upcoming long weekend.

Students spill into the classroom, pulling on their indoor shoes. I prepare my notebook and sit down at the back of the classroom. On the board there is a Venn diagram. The overlapping circles are titled "I'm wearing blue jeans," "My shirt has red on it," and "My shoes are mostly white." As they go to the board to place their magnetic nametags in the appropriate spaces, the students are chatting with friends. Aidan shows his pals a new sticker and passes out extra ones. Karen is putting on her FM system microphone as she walks towards the board.

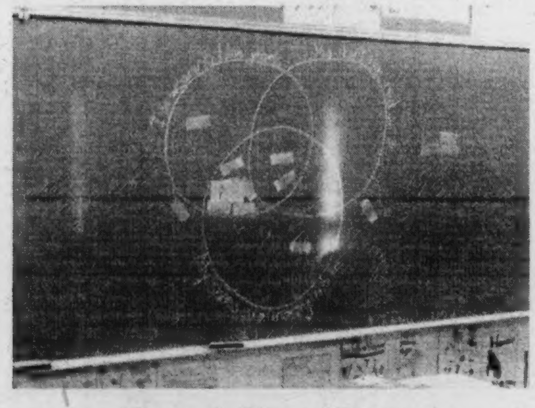

Figure 1: Venn diagram

She mentions that three students are absent and then adds lines on either side of the diagram. She comments to the class that she thought they might have difficulty with three circles, since their experience up to now has been with two circles. She asks why they think she drew the two lines. Alex, the tallest boy in the class, replies that it is a way to tell the difference between students who do not belong to any of the three circles and students who are absent. Karen asks students what they know about Alex and Nicholas by looking at the diagram. Immediately Anne's hand goes up and her glasses slip down her nose; she says that Alex and Nicholas are not wearing blue jeans, they do not have red on their shirts, and their shoes are not mostly white. Their nametags are outside the circles.

The announcements come over the intercom, and then we all stand and sing *O Canada* along with the music. Karen settles onto a bench at the front of the classroom and reads aloud from a novel, *The Girl Who Owned a City*. Students are following intently, except Samantha, who is quietly reading *Bridge to Terabithia*. She has surreptitiously tucked the book into the opening of her desk.

Karen makes a few comments on the storyline and then passes back the Problem of the Week, or PotW, as it is shortened in this classroom. She tells the students that this one was challenging. It reads:

Next summer, I need to seed my backyard with grass. It is about 14 m wide and 8 m long. The grass seed costs $10.98 for a bag, and each bag will plant 45 m^2. How many bags of seed will I need, and how much will it cost?

She draws a rectangle on the board and labels the dimensions. She asks where would be a good place to start. Kasey says that you could multiply 14 times 8. Karen asks what 14 times 8 would tell us. She turns to Damian and he responds with, "Perimeter...no...area"[22]. Karen asks some students to describe a way to solve the problem and what to do with the area. Several students explain how they found the area (112 m^2) and divided by 45 m^2. To find the number of bags needed, they rounded the previous answer (2.48...) to 3 and then multiplied by the price per bag, for a total of $32.94. Khalil mentions that the store might sell seed in half-bags; he incorporates that idea into his explanation, for a total of $27.45.

Karen then introduces a practice question that is similar to their next PotW: *Think of as many interesting and amazing things as you can about the number 100. You can think about place value, patterns, fractions, decimals, shapes, angles, operations (+, -, ×, ÷) or anything else that comes to mind. Originality counts.* Students work with their seat partners, absorbed in the task.

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[22] When I use quotation marks around the words of Karen or her students in this text, it means the words are taken verbatim either from transcripts of conversations and interviews or from field notes, where I regularly recorded their words as faithfully as possible. Ellipsis points used without spaces indicate pauses in speech.

Renee and Mariah are partners. Mariah looks at me and asks if ten times ten is a hundred. Renee says that it is, and checks on her calculator. Soon Renee and Mariah are seated close to Karen at the C-shaped table at the side of the classroom, discussing possible answers. From across the room where I am working with Sophie, I see that all three are bent over the page in front of Mariah. After about ten minutes of work, students write their favourites on overhead transparencies. Karen picks up the overhead pens so that students will stop writing and attend to the short presentations. Ella and Nicholas are first. There is still some chatting and Karen says, "I admire that you are finishing up, but I also want to make sure Ella and Nicholas have an audience."

In one of her answers, Ella confidently reads 4.16 as four hundred and sixteen. Karen says, "Oh, how do we read that number?" and Ella responds correctly. Next up, Renee shares that 50 × 50 – 150 = 100. Karen asks her to check that and then to try 50 × 5 – 150. Emily pipes up, "I think you were thinking 5 × 50." As the last pair is presenting, the recess bell rings. Karen asks students to stay while the partners finish up.

Karen then hands out the new PotW:

I know it's hard to believe, but this year your principal, Mr. Woods, turned 50! Your job is to discover exactly 10 interesting or amazing things about the number 50. You can think about place value, patterns, fractions, decimals, shapes, angles, operations (+, -, ×, ÷) or even do some research on the Internet to find facts involving the number 50.

Nicholas grabs the basketball on the way out of the classroom and recruits some classmates to play a game with him. Anne takes off her shoes and stows them in her cubby; Josh kicks his off and leaves them in the middle of the hallway before pulling on his outdoor shoes. Karen and I head to the staff room. She is carrying a stack of marking for after recess, since the students will be doing physical education with another teacher.

We chat over a cup of tea as Karen shows me some of the work her students have been doing in mathematics. She mentions that she likes to be early for the physical education teacher, who goes on to another group of students after teaching Karen's sixth graders. We head back down the hallway.

When the students return, Karen shows them different papers that are available for working on their face collages. She reviews a few techniques, including tearing the paper into small pieces. Karen assigns students to groups for sharing the paper. Students work with intensity on their projects. One group works in the hall. The boys are all in one group, at and around the C-shaped table. Free-flowing conversations take place all over the class, about junior high, video games, music, families, and plans for the weekend. The conversations always return to the collages and to choices of paper and placement. Karen and I circulate amongst the groups, walking carefully around the projects on the floor, answering questions, commenting on the collages, and joining conversations.

The bell rings for lunch and most students continue to work on their collages, though some boys have bolted for the computers. The group in the hallway cleans up quickly as students from other classes stream down the corridor. Karen asks that everyone clean up, calling Nicholas, Josh, and Damian back from the computer stations.

Today is lunch in the classroom. Once a week Karen spends part of her lunch hour with her students, chatting and allowing some free, though supervised, computer time. Students move easily into friend groupings, and tell each other when their food is ready in the microwave oven in the hallway. Karen tidies her desk area and makes some preparations for the afternoon. She then eats a quick bite of lunch and joins a group playing math games on the board. Renee and I play Mancala on the carpet. Ella sits with us as we chat. Renee tells me about her family and how her older sister moved out recently. She says she misses her.

At noon, Karen asks everyone to tidy up before going outside. She heads across the hall to unlock the empty classroom for the Lego Club, which she supervises every Friday. The ten students, boys and girls, take out the Lego materials, leftovers from Karen's own now-grown family. Most students continue their work on a personal project. Khalil is building a convenience store, Alex has a garage, and Sophie is working on an addition to her house. Karen and I kneel next to them, helping them to find certain pieces and listening to their plans.

When the bell rings, students put away their projects and the leftover Lego. Back in the classroom, it is time for science. Karen tells students that she has never been brave enough to try this experiment with a class because there is a delicate procedure. On the big screen she displays a computer document that starts with these questions: Does air have weight? Does a balloon full of air weigh more than an empty balloon? It also includes the titles: Hypothesis, Materials, Procedure, Diagram, Observations, and Inferences.

While Karen takes a phone call from Nicholas's grandmother, Khalil quietly asks if anyone is taking I.B. (International Baccalaureate) next year. Several hands go up and students whisper about their plans for junior high. Nicholas watches Karen intently as she speaks on the phone.

When Karen asks students to predict what weighs more, a blown up balloon or an empty balloon, the answers vary. Karen responds with, "Why do an experiment when you already know the answer? Scientists do experiments to test out their hypothesis." When she asks how we might test the question, Khalil, who predicts that a blown up balloon weighs less, suggests throwing both up in the air and seeing which one hits the ground first. Karen talks about how the blown up balloon is "running into air." She refers to their work the day before about air pressure. She also mentions Galileo's experiment at the Leaning Tower of Pisa, where he dropped two objects of different weight but the same shape. Karen searches for a ping-pong ball and, finding one, says that, if she had a golf ball, she would show them that the two objects fall to the ground at the same rate. She sends Khalil and Nicholas to the gym to get a golf ball.

Anne suggests using the balances in the math lab. Karen affirms that it is a good idea but adds that the balances are not sensitive enough. Karen then suggests some materials that would help. Katie types them into the document on the screen: metre stick, two balloons, piece of string, masking tape, tack. Thomas continues to suggest using the scales, but adding the same weight to both sides. Karen says that the difference between them is "so small." Thomas suggests using the string on the meter stick in order to find the middle. Karen builds on this idea by adding that they will tape a blown up balloon on either side of the metre stick and then let the air out of one by making a hole with a tack. Thomas says that if you move the string after you pop the balloon, it will make a difference. Karen suggests putting masking tape on the string after the stick has been balanced.

Nicholas and Khalil return with a golf ball. Karen invites everyone to the carpet near the C-table. She drops the ping-pong ball and the golf ball at the same time. They hit the carpet at the same time and some students seem surprised. She demonstrates again and talks about how gravity attracts the objects to the ground at the same rate.

As students return to their desks, Thomas says that the balloons might not really weigh the same amount and might not have the same amount of air to begin with. Karen responds by saying that the trick is to balance the balloons first and to have them about the same size when they are blown up. Karen says, "Thomas, you think like a scientist, you're thinking of what you need to be careful of in an experiment." She types out the procedure on the screen. One part reads, "Carefully use the tack to put a small hole near the neck of one balloon to let the air out." Karen grins and says that this part is important.

Once students have copied down the procedure, Karen asks, "How could this experiment go wrong?" Anne says that the balloons could pop. Nicholas says that people could use the tacks irresponsibly. Karen then asks how the science could go wrong. She elaborates on a few things that might make the science difficult.

Karen then takes a few moments to review the group work sheet posted on the board. It includes suggestions from students and teachers about how to work with others, such as: focus on the task; work carefully (help each other); get along; get help from other students if possible; follow instructions accurately; use materials responsibly, carefully, correctly; put materials back where they belong; read carefully; record work, neat + complete; don't disturb other groups; and clean up.

Karen concentrates on getting along, which, she says, is about being polite and respectful. Using *random sticks* (popsicle sticks labelled with each student's name), she forms groups of three and gives each group the materials needed to complete the task.

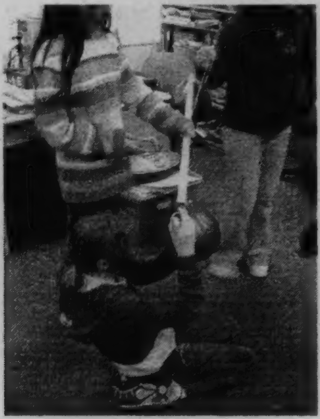

Figure 2: Balloon experiment

As Karen helps one group (Nicholas, Samantha, and Mariah), the balloon pops and they must begin the balancing again. As I circulate amongst them, the other groups work at balancing and then letting the air out of one balloon. There is some joking between some group members. Mariah roams the classroom, commenting loudly on others' work. Some students struggle with the static electricity that attracts the balloons to their clothing.

Once a number of groups have finished, Karen invites everyone to the carpet again. She is holding three of the metre sticks with balloons. She says that we will first look at the science and then at the group work, adding that both are important. She shows one of the metre sticks. The balloons balance and then dip down with the filled balloon toward the ground. The balloons balance again briefly and dip in the same manner. Karen says that the weights are so close that the difference is very difficult to measure.

Karen asks students to reflect on their work during the experiment. Mariah makes a face at a classmate on the other side of the carpet and then whispers to Katie, who is next to her. Karen uses the random sticks to ask individuals about their behaviour. She asks them first to say what went well and then to say what they might improve on, with special reference to the sheet on group work posted on the board. Several students evaluate their own work in groups. Students discuss the actions of Nicholas and Mariah within the carpet group at the moment and also earlier in the experiment groups. Karen says that Nicholas did not pop the balloon on purpose and then asks Mariah to make better choices, as she has an impact on everyone.

Karen asks students to return to their desks to finish answering some questions about the experiment. She reviews the difference between observations and inferences using some examples from the afternoon. She quietly invites Mariah into the hallway to chat. Karen checks to make sure the FM system is switched off so that the students in the classroom cannot hear her. Mariah's arms are crossed as she stalks out. When Karen returns, she posts agenda items (homework) on the board, including the new PotW and the science sheet on air and aerodynamics. Mariah walks calmly over to her desk and copies the information into her agenda. Karen also posts the desk change, asking students to wait a few minutes before moving their desks to sit with a new partner. As they are settling in to their new places, the bell rings to indicate the end of the school day. Students pass into the hallway. Several linger to chat with one another and with Karen.

Though Karen has plans for the evening, she listens good-naturedly to Damian, who is avoiding going to day-care, and to Sophie, who tells a story about her dog. Anne joins in, adding that she will help take care of her little cousin when she gets home.

Though the bell rang at 3:30, it is almost 4:30 when the last students leave, smiling and waving. Karen finishes some preparations for Monday. As we walk down the long corridor toward the parking area, I notice a few teachers working in their classrooms. One is playing some soft music that wafts in to the hall. Another is changing the posters outside her classroom door. The afternoon is warm and the sky is blue, a perfect beginning to the weekend.

From a *Day in the Life* to a *Way of Life*

The *day in the life* I describe above is not an actual day that passed, but the parts of the day are a collage of the many days I spent in Karen's Grade 6 classroom. Like a student working on a collage, I looked carefully over the field texts available: field notes, conversation transcripts, letters, accounts, and classroom materials. Just as the playground gets muddy where the grass meets the pavement, the edges of care are ambiguous. Using my impressions of Karen's classroom over the four months of fieldwork, I selected pieces for this composition to highlight the shape and texture of care that I witnessed and participated in. I placed events and moved them around. I returned to my field texts and read my composition over and over again. I read it aloud to myself and to different audiences.

The *day in the life* can be called a fictionalization of classroom events. As I responded to my composition and received the response of others, possibilities for care and for resonance with experiences of school emerged. I offer this *day in the life* as both a typical and an extraordinary day. During my time of working with Karen and her students I came to realize that care can be found in the most usual and unusual places. Sometimes care is buried in routines or politeness, sometimes it is raw and complicated, sometimes it is as simple as sitting or not sitting next to someone. Each reader brings his or her own experiences of care and of school to the *day in the life*. My composition brings forth the contours of care that I saw in Karen's class as well as difficulties of care that I too have encountered. The collage also acknowledges and conveys the excitement, richness, and complexity of life in Karen's classroom.

In this *day in the life* and later through found poetry, I try to create "artful portrayals" (Butler-Kisber, 2002, p. 229) of Karen's classroom. Lynn Butler-Kisber writes that artful portrayals "have the capacity to pull the reader/viewer into a world that is recognizable enough to be credible, but ambiguous enough to allow new insights and meanings to emerge" (2002, p. 231). As I begin to unpack the meanings that I made (and continue to make) from my time with Karen and her students, I recognize that the reader will make different meanings. The possibilities that I offer here are those that resonated (Conle, 1996) with my personal experiences of care and with my relationships with Karen and her students.

I begin by revisiting in the context of this *day in the life* the characteristics of care as described by Noddings (1984): motivational displacement, engrossment, movement toward an ethical ideal, and reciprocity. I also share further stories from the classroom that add dimension to the words on these pages, more a *way of life* than a *day in the life*. The stories I share come from my field notes, accounts, and weekly conversations with Karen, and also from the student interviews at the end of the study. The students had very definite opinions about what care is. I think it is important to share their ideas here to explore another layer of an ethic of care. Finally, I explore the idea of proximity as it pertains to care.

During my time in Karen's classroom, Noddings was one of many "ghosts in the classroom" (Lawrence-Lightfoot, 2003, p. 3). Her writing and ideas shaped what I noticed and what I thought of as care. I begin with the ghost that Karen and I both noticed and talked about; other ghosts come later. Noddings writes, and I agree, that "[t]he student is infinitely more important than the subject" (1984, p. 20). For this reason, I choose to place this chapter, which is centred on the teacher, Karen, and her students, *before* the chapter that focuses on the mathematics (Chapter 5). It is a structural nod in this dissertation to the heart of an ethic of care: responsive relationships among people.

Motivational displacement, engrossment, and movement towards an ethical ideal are essential to an ethic of care. These three are deeply entwined and sometimes indistinguishable. Instead of treating each separately, I address them together by referring to them as *profound attention.* This is a departure from Noddings's terms, though one that serves to describe care in a distinctive way, as Karen's care is distinctive. Another of Noddings's characteristics of care is *reciprocity* — attention being responded to and returned. I want to describe in depth the profound attention and reciprocity involved in caring for ideas, particularly mathematical ideas, not in isolation, but rather in the context of caring for students in an elementary classroom. Through these descriptions, I hope to widen notions of an ethic of care.

In the next two sections, I explore profound attention and reciprocity as a way of tracing the outlines of care in Karen's classroom. At the end of the chapter, I turn to the idea of *proximity* to extend Noddings's characteristics of care and to further describe Karen's care both for her students and for mathematics.

Profound Attention

In this section, I unpack some of the moments of profound attention from the *day in the life*, adding other stories from the classroom to highlight a variety of forms of care. *Profound attention* is the term I give to the characteristics of motivational displacement, engrossment, and movement toward an ethical ideal.

When Karen talks with and listens to Damian, Anne, and Sophie at the end of the school day and school week, she puts her own needs and plans on hold. The relationship with students is immediate and their needs are central to Karen's caring work as a teacher. She has plans with her family for later in the evening and some preparations to make for next week, but Damian, Anne, and Sophie are close; for various reasons, they are at the front of Karen's mind and they are physically there, in front of her. A few minutes of conversation mean she must reorganize her schedule, perhaps to do some Saturday morning marking or to make a trip to school on Monday, when she does not normally teach.

All three students have been challenged by different parts of mathematics and persevered through frustrations. Damian has had difficulty staying focused on mathematical tasks. Karen has been supporting him in finding strategies to help his concentration. Karen also recognizes Damian's reluctance to attend day-care; he is the oldest child in the centre by about six years. As he gets older, his interests shift and playing with the young children is no longer a priority. He is an only child and is used to the adult company of his mother and his baba (grandmother). Anne, who says that she is good at math games, but not at operations, has been having health issues. Karen checks in with Anne about how this is affecting her. And Sophie, with her long braid, is a sports enthusiast who loves to talk about her basketball, floor hockey, and soccer games. In the last few weeks she has also been trying on different personas, trading in her sporty look for form-fitting jeans and talking about cutting her waist-length hair. Karen listens and responds to all three in ways that show she has been paying attention to them. Her manner is casual as she jokes with them. She is both present in the moment and aware of what has been going on in their lives over the last days. This awareness and interest are bound up in what I mean by profound attention.

Karen's *care*-full attention pervades her classroom. Earlier in the *day in the life*, when Nicholas and Ella are preparing to present about the number 100, Karen asks students to stop their mathematics work and to focus on their classmates. She puts a positive light on their chatting by saying: "I admire that you are finishing up, but I also want to make sure Ella and Nicholas have an audience." Karen points out that although the mathematics they are caught up in is important, their classmates need their attention in this moment. Noddings appears here as an accompanying ghost; Karen prompts the students' motivational displacement and nurtures an ethical ideal as students put their interest with the task and the mathematics on hold in order to listen to Ella and Nicholas. Karen encourages profound attention and at different times describes the body language that is involved: looking at the person and listening with interest. There is a subtle shift as students both literally and figuratively turn away from their own mathematics toward their two classmates and their mathematical thinking.

These two classroom examples of profound attention echo the sentiments expressed by students in their interviews. Thomas says that when you care you "listen." For Ella, a caring teacher would "help you with work and stuff . . . like help you understand it." She goes on to say that to care you must "listen" and "pay attention." Aidan says that when a person cares for another, "They put the person they're caring for first and everything else second." He continues by explaining that when he broke both his arms, his mother left his sister and her friends at a party so she could rush him to the emergency room.

The care Aidan describes is closely linked to health. This is a topic that comes up over and over again for students. They describe accidents and hurts (physical and psychological) that others have helped them through. Anne tells me about her cousin who carried her when she hurt her ankle and about babysitting her little cousin who scraped his chin and knee when he fell down in the park. She helped him up, hugged him, and wiped up the blood before putting on a bandage. Hannah describes travelling to another country and living there for several months to help take care of her ailing grandmother. Renee shares that Anne comforted her when she was sad and that Anne does this for other classmates too. For students, attending to personal safety is part of what it means to care.

In the *day in the life*, Karen pays attention to physical and mental health as she talks with Anne, Sophie, and Damian. On the playground, when she is supervising or when we are testing paper airplanes, if a ball or plane goes onto the nearby street she stops traffic and retrieves the item. This is a regular part of playground supervision, but Karen carries this attention into the classroom.

Aidan, one of the taller boys of the class, comes in from one recess visibly upset, his face flushed. He advances menacingly toward Josh, who is much smaller. Karen talks to him alone and later calls a class meeting. The students sit in a circle on the carpet and pass around a small stuffed animal that signals their turn to talk. They talk about the game that targeted Aidan, where students went up to him, yelled "Burn!" and then ran away. What started as a game of verbal tag ended up as social bullying. Karen asks students to think about how Aidan looked when they were playing and to describe his body language then and now. Karen takes the time to attend to Aidan and to all the students, to really listen to each of them, even if their actions during recess were not kind.

I get to know Aidan better over the next few months. Like Damian, he is used to being around adults and speaks directly. When I attempt a computer game that is popular with the class, Aidan helps me in the virtual world by leading me step-by-step through certain tasks, prompting my actions by commenting on the environment, and giving me materials that I need. This help is care in a virtual context that is based on our classroom interactions.

At the end of the school year, Aidan candidly shares his ideas about care. In addition to personal safety, he points out that caring for someone who is learning means to help that person, to ask him or her questions, to work on the problem together, but not to give the answer. Samantha echoes this point when she says of a caring teacher: "They don't just tell you what to do." The person doing the caring might find that the encounter would be easier or might finish faster if he or she gave the answer, but he or she sets this aside to work on the mathematics with the person being cared for. Interestingly, care in a mathematics class can mean responding dynamically to both the expressed and the perceived needs of the cared-for as well as to the "needs" of mathematics. Judicious telling (Chazan & Ball, 1999) and getting involved with another person's thinking can be a means of supporting a caring relationship between a person and the math, so that he or she can experience the pleasure and the accomplishment of solving a problem. Aidan takes his words seriously. In class, he painstakingly explains his mathematical thinking and strategies to the class when Karen asks him to. He does not go directly to the answer.

Karen echoes this idea in our conversations and in her teaching. Part of what it means for her to care both for her students and for mathematics is to set aside her own pedagogical desire[23] (jagodzinski, 2002) to explain. She reports that at the beginning of her career, she was proud of the clarity of her explanations. But she came to realize that the clearest explanation did not make sense to some students and that there was something more to do than to explain.

As the complexity of teaching unfolded, it became more important for Karen to find common ground with students as they work on a math problem. Karen listens, asks questions, makes comments, and observes as she works alongside Renee and Mariah at the C-table so that she can better understand their thinking and learning. But Karen also draws on her deep knowledge of mathematics and her years of teaching experience, of working with hundreds of students on many different mathematical problems. As she cares for her students and their learning, she also cares for the math. One way that she describes this care is through the idea of *making sense*.

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[23] Mary Boole, wife of the mathematician George Boole, wrote about education in general and mathematics education in particular. She described a phenomenon similar to pedagogical desire: "teacher lusts" (Tahta, 1972).

Making Sense

As we talk about what it means to be a teacher of mathematics, Karen observes, “We can’t make sense of things for them.” Instead of pulling a student into a teacher explanation, Karen thinks about the connections the student is making in the mathematics. She invents ways to explore lines of thinking. In other words, Karen re-examines her assumptions about what students understand as she reads their work and attends to their questions and explanations.

This emphasis on making sense is at work in the *day in the life*. The PotW is designed to accommodate a variety of ways of making sense of the problem. For the lawn seeding question, Khalil’s answer of using a half bag, which might be considered incorrect on a multiple choice test, is accepted and supported because of the sense he has made of the mathematics through the given context and his experience with shopping. Later, as students present their work, Karen makes space for making sense as she values students’ individual and group reasoning.

Making sense has an air of continuity, generation, and creation. When Karen talks about making sense, she points to drawing meaning from experience. For example, in a class chart about heights, Renee records her height as 163, while Sophie writes 1.57. Karen asks if that means that Renee is a hundred times taller than Sophie. With a humorous twist, she invites them to draw on what they know about measurement as well as what they know of Renee and Sophie to make sense of the numbers. The students do not stop making sense with an *ah-ha* moment (or even a *ha-ha* moment), but connect new realizations to previous ones and try out possibilities for their understanding.

Sophie is an example of a student who, in Karen’s words, is “busy making all kinds of connections.” She works hard at making sense of subtraction of decimals. She writes:

$$\begin{array}{r} \mathbf{450.}0 \\ \underline{\mathbf{-265.}4} \end{array}$$

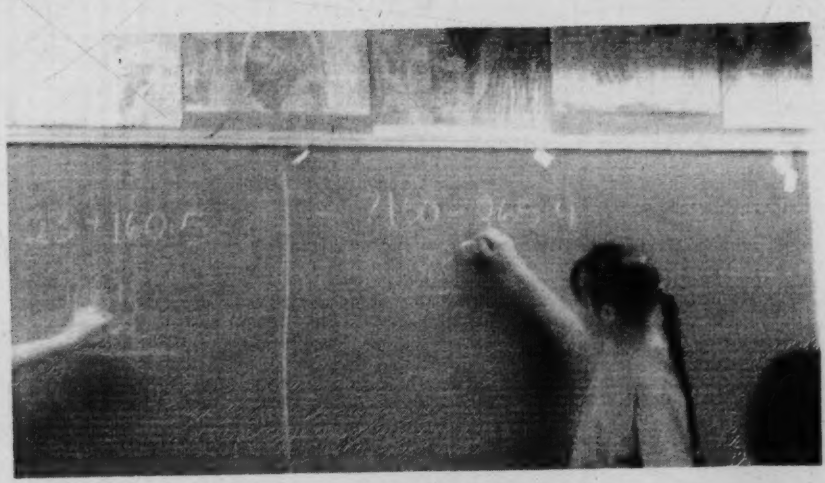

Figure 3: Sophie's light writing

The decimal portions are written very lightly and only after she has written the whole number portion of each number. Karen asks Sophie to explain her strategy. Sophie responds, “It’s missing the point-four because I’m pretending it’s imaginary and I put it after.” Sophie’s light-writing strategy, though not in keeping with conventional mathematical notation, hints at her ideas around decimals and fractions, and how they are not quite, as Sophie puts it, “full” numbers (which is similar to the way school mathematics describes decimals and fractions informally as being different from “whole” numbers). Sophie also connects the subtraction of decimals to the traditional subtraction algorithm that she uses for whole numbers. Karen recognizes Sophie’s sense-making and responds immediately by attending closely. Over the next weeks, Karen works with Sophie individually and sets class tasks related to fractions and decimals. Karen’s care is both instantaneous and evolving over time. Her profound attention can be described both as motivational displacement, a suppression of the rush to tell and to set “right” the notation that Sophie is using, and as engrossment, as she makes her availability and continued presence clear.

In a conversation, Karen continues: “There’s a world of difference between saying ‘Okay, work with your partner and see if you can figure out a way to do that’ and saying ‘Okay, the first thing I want you to do is take your hundred and trade it in for tens and that’s how we write it here.’” As she opens mathematical problems to students and remains receptive to their solutions and strategies, she recognizes their sense-making abilities as well as the sense within mathematics. She says that students make their own sense of things and that mathematics “must” make sense. In our weekly conversations, Karen talks about the intricate structure and necessary relationships of mathematics. Through making sense, she cares both for students and for mathematics.

Like care, making sense is complex. Karen tells the story of Darren making sense of the seasons. He is a former student, but some current students know him and he recently visited the school. He is another one of the ghosts in the classroom whose spirit is summoned through repeated tellings of this story.

Darren, Karen begins, is a sweet kid. She continues, "But anyways we were talking about the seasons. I have the globe. I'm putting in the sun and we're doing all this stuff . . . it's not like they knew it's tilted. And so I said if we travel around the sun we're always tilted the same way, so sometimes we're tilted away. I said it's not like the earth is here, summer, and then it flips over and we have winter. And now we have summer and now we have winter. Anyways we have a little laugh about that." Karen tells me that weeks later the class visited a junior high school. A teacher gave a similar demonstration using balls of different sizes and a strong light. The teacher then asked students if they knew how the seasons worked. Karen continues, "Darren says, 'Yeah. Sometimes it tips forward, and tips away, tips forward.' All he heard of that whole thing was **not**: it's **not** like this . . . . He remembers something about the earth going like that."

Making sense of the seasons is not easy. To imagine the whole solar system encapsulated into a few moving balls and a strong light is not necessarily convincing. It does not easily tie in to students' experiences of the four seasons, with weather changes and rhythms of nature. Karen does what she can to support students as they work at making sense of the demonstration. In Darren's story, Karen shakes up the role of teacher-as-explainer as well as blanket acceptance of hands-on tasks. Teacher explanation and a demonstration are not enough for Darren to connect his physical experiences of the seasons (not flipping) to his "scientific" ideas (flipping). Karen and I invoke Darren's story in many of our conversations as shorthand for how explanation is necessary but insufficient to teaching. For Karen, part of caring as a teacher is to consider both the student and the context in creative ways, which may include explanation, hands-on tasks, demonstrations, and so on. Karen's care also involves making sense as she reflects on her teaching and parenting experiences and lives out ways of being with her students and with the subject matter that are in keeping with those experiences.

There is a subtlety to this profound attention that is tied to temporality. As Karen sets aside her wish to make sense for her students, she also sets aside a controlled timetable. This is difficult to do in a school, but in Karen's school the only bells signal recess and lunch. In the *day in the life*, Karen extends the math time and moves the collages to later in the day because of the interest Renee and Emily expressed in the math questions they were writing. In our conversations, Karen talks about wanting to "manage every minute." Though she posts a schedule for the day on the board, the times are fluid and the schedule changes to include topics that interest or challenge the students. After one day, Karen says, "I meant to get health going earlier, but when math is going so well," she re-arranges the schedule. She and her students let time fall away as, together, they become engrossed in an idea. This fluidity is not always easy. It demands negotiation with students and subject matter. There is an element of uncertainty in the day, even though Karen knows both her students and the subject matter well. This is an example of enacted care. It points to another way that Karen cares both for students and for mathematics: by *improvising*.

Improvising

As with making sense, improvisation involves a spirit of profound attention[24]. Karen has a plan, on paper and in her head. She has taught this subject matter before and has memories of how it usually goes. She also holds remembered images and expectations of what it means to teach. Some of those images and expectations have to do with a controlled, quiet classroom, with students working individually at desks; these are ghosts of Karen's own days as a student. But the care that Karen expresses for her students and for math does not always fit well with those images and expectations.

As she encourages her students to make sense for themselves, some students require materials to work with or people to talk to. As she attends to students and to their understandings, she responds dynamically to what they write, draw, or say. Some students become distracted as they encounter frustrations with mathematics. Karen responds to them as well. Improvisation is essential to Karen's care as she sets aside certain plans, images, and expectations, depending on the context. In the *day in the life*, Karen improvises in science as she responds to Khalil's prediction that the balloon that weighs less will hit the ground first. First, she takes the prediction seriously. She reminds everyone about the friction of the blown up balloon running into air as it moves toward the ground, while the deflated balloon runs into less air because it has a smaller surface area. Karen improvises on these ideas, but the connections to the previous day's work are close and fresh. She refers to historical evidence: an experiment by Galileo. This part is completely improvised. She keeps Khalil involved in exploring his prediction as he searches for a golf ball to drop with a ping-pong ball.

Before Khalil makes his prediction, Karen has a plan for the afternoon, based on the mandated curriculum and shaped by her teaching experience. But, seeing an opportunity to help students engage with their scientific understanding, she suspends the plan in order to investigate Khalil's hypothesis. Though the moment that I chose to include in the *day in the life* is centred on science, Karen improvised in all subject areas, most notably in mathematics. Though I concentrate more specifically on mathematics in the next chapter, I now bring forward another moment to expand on the idea of improvisational care.

One morning, Emily offers to help Renee with her math homework. They sit side by side at the C-table. Renee and Emily both become interested in sum/product questions like the question assigned for homework ("Find two numbers whose sum is 15 and whose product is 56"). They decide to make up a couple of their own questions. Emily comes up with "Find two numbers with a sum of 25 and a product of 100." Renee's question involves a sum of 16 and a product of 64. Emily shows her question to Karen. Karen asks her to write it on the board. Once everyone is ready, Karen invites students to solve Emily's problem. Nicholas says that he does not want to. Mariah chants similar words. Karen says that Nicholas started by being disrespectful and Mariah was happy to join in. She continues, "If you are choosing not to participate, the minimum I expect is for you to be polite. I can't force you to think about it."

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[24] For more on improvisation in mathematics education research, see Gordon Calvert (2001). In particular, she uses dramatic improvisation as a metaphor for research and for teaching and learning mathematics.

She turns to Emily's question and asks for a variety of numbers that sum to 25. She writes down students' suggestions: 13 and 12, 10, and 15, 21 and 4, and 20 and 5. For the first pair, she says that the numbers are too close together. The product is 156. She says that it is like a square. Discussion continues. The product of 10 and 15 is 150, too high, and the product of 21 and 4 is 84. Nicholas answers this one and Karen teases (not sarcastically), "Don't tell me you were thinking. I caught you thinking about the problem." Nicholas grins. She says that 84 is too low, that the numbers are too far apart. The last pair of numbers works. She suggests that students could make their own "crazy hard" question with the calculator. Karen asks Renee to read her question. She gives students some time to think. Hannah answers correctly.

Karen attends to the students and to how they are caring (or not caring) for one another. She shapes a relational atmosphere through her words to Nicholas and Mariah. She is both firm in stating what she sees as an ethical ideal as well as gentle as she uses humour to show that she values student thinking. At the same time, she attends to the mathematics the students are working on. When Emily and Renee become engrossed in inventing and exploring mathematical problems on their own, Karen improvisationally takes up their interest to share with the whole class.

I would like to emphasize here that, through her profound attention, Karen is *in harmony* with her students and mathematics. The improvisations are not abstract, jazzy displays of her expertise. She keeps the harmonic structure of conventional mathematics while listening for the melodic strains of her students' individual understandings. Both the harmony of mathematics and the melody of student understanding are connected and heard.

In her article comparing conceptually-oriented[25] mathematics teaching (as opposed to calculationally-oriented) to jazz improvisation, Karen D. King (2001) writes that improvisation is "to enact the music in a performance, with the expectation of moving beyond what is written on the page" (p. 13). She continues, "the performer makes use of forethought, remembrance, previous knowledge and new ideas in the enactment of this moment" (p. 10).

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[25] According to the framework described by King, Karen Marks could be considered a conceptually-oriented (as opposed to calculationally-oriented) mathematics teacher. Though they are not the focus of this paper, I think that Karen Marks's rich images of what it means to teach and learn mathematics are evident in the classroom moments I share here.

As Karen Marks works with students, she brings all of these elements to fruition. She interacts dynamically with individual students and with the whole class in the moment, building on the structure of a song she already knows: her knowledge of previous students, prescribed curricula, mathematics, and much more. She and her students co-perform the improvisation, though Karen is most often the lead improviser. As lead improviser, Karen's role can also be described as caring. She really listens to what students are saying and to what songs students are playing. The school mathematics curriculum is not a song to be played note for note. Rather, it becomes a context in which to encounter and play with her students so that they may grow, learn, and care.

Reciprocity

In addition to the profound attention that is characteristic of care, Noddings adds that reciprocity, the possibility of attention being returned, differentiates human care from care for animals, plants, and ideas. It is through reciprocity that care is completed as the carer and cared-for receive and respond to one another. In their interview, Samantha and Kasey told me that care "makes you happy and other people happy." There is something deeply satisfying about care. While maintaining that there is something different and special about human care, I claim that a sense of reciprocity in feelings of accomplishment and pleasure can also come from working on mathematics.

The reciprocity at work between Karen and her students is expected, and perhaps taken for granted, in classroom interactions. Karen sets a task that she has carefully crafted or selected, such as the opening Venn diagram task in the *day in the life*. The students show their care for her (and for mathematics) by working on the task and answering questions. This care is sometimes in line with their interest in the challenge of the question, but the students often set aside their own interests (chatting, reading a novel, daydreaming) to work on the tasks Karen offers. This can be described as motivational displacement, a characteristic of care.

During times of chatting or noise that interrupts learning, Karen often invokes the reciprocity in their relationship. One day Emily asks a question about homework and then begins chatting with her partner as another classmate explains his work, Karen says, "This is especially because you were wondering about this so I need you to listen." She does not say, "Stop talking. You should be listening." Though the effect of the two statements on Emily's behaviour might be the same, Karen reminds Emily that she has involved the class in Emily's question and that Emily has an important part to play both in the exploration and in caring for Karen as a teacher. On the surface, this might seem like a simple request for politeness, but there is a deeper request. Specifically, Karen says: "I need," and calls on Emily to care for her since she has cared for Emily. Emily's care for Karen need not be the same as Karen's care for Emily; reciprocity in care does not imply equality. But reciprocity also has other subtler facets.

The reciprocity with caring for mathematics is not *real* in the sense of Nicholas responding to Karen with a smile or putting effort into a task. However, there is a back-and-forth relationship between people and mathematics in the Grade 6 classroom. In our conversations, Karen often mentions the "payoff" of mathematics. She refers to patterns (such as those in the decimal and measurement systems), relationships (such as in statistics), ease with calculations (such as how knowing how to multiply can make other mathematical work less demanding), and generalizations (such as figuring out how one problem works and applying it to a class of problems). Karen speaks about mathematics as though it gives back to those who work at making sense of it. She evokes a sense of receiving something (ease, elegance) from the structure that humans have created in mathematics.

In one classroom moment, Karen is surprised by the reciprocity in Khalil's measurement conversion. The class is looking at 1500 m = ____ km. Khalil, sitting in the front, answers softly. Karen asks him to stand and repeat what he has said, especially for those sitting in the back. He explains that one thousand metres is one kilometre and five hundred metres is half a kilometre or zero-point-five[26] (0.5) km. So, he continues, fifteen hundred metres is one-point-five (1.5) km. He speaks easily and confidently about the relationships between metres and kilometres as well as the decimal representation for half. Earlier, Karen had been encouraging students to make sure their answers made sense. When Khalil has finished, she tells students that this is an example of making sense of an answer.

Underlying Khalil's ease with conversions is his ease with numbers, such as knowing that fifteen hundred is one thousand and five hundred and knowing that five hundred is half of a thousand. He also knows that half can be written as zero-point-five (0.5). The number relationships, base ten concepts, and fraction ideas are closely linked to decimal and measurement relationships. They follow the same patterns. The work he has already done to understand numbers is giving something back to him in measurement conversions. There is reciprocity in the relationship between Khalil and mathematics: he works at understanding the connections and concepts and, in return, he receives relationships that can be used elsewhere. This reciprocity is similar to the kind described by Noddings, but she does not particularize the reciprocity to the context of the nature of mathematics. I now begin to extend Noddings's characteristics of care.

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[26] In this text, I use hyphens between the words used to describe a decimal number in order to clarify which number is being referred to and to acknowledge the way the words were used in the classroom (to represent a single number).

In this story about Khalil, care is again linked to making sense and improvisation. In our conversation about this classroom moment, Karen mentions that this making sense is new for Khalil. He had long relied on algorithms and Karen had expected him to answer the question by talking about "moving the decimal." Instead, he goes to the meaning of the numbers and connects this to the conversion. Karen cares for her students and for mathematics by creating spaces for students to make sense as she provides time to work and to talk with others, by improvising at will, and by stopping a recital of answers to allow the sense-making to shine.

Karen provided space in her classroom for me to care for both for students and for mathematics. I developed a caring relationship with each of her students as I worked with them; every one was receptive. The textures of these relationships come alive in some of the stories I share in these pages. As for my care for mathematics, a particular event comes to mind. Karen uses a task about number patterns. She starts a pattern and then leaves the next step blank for students to think about. Students then make up their own patterns and their classmates find the next step.

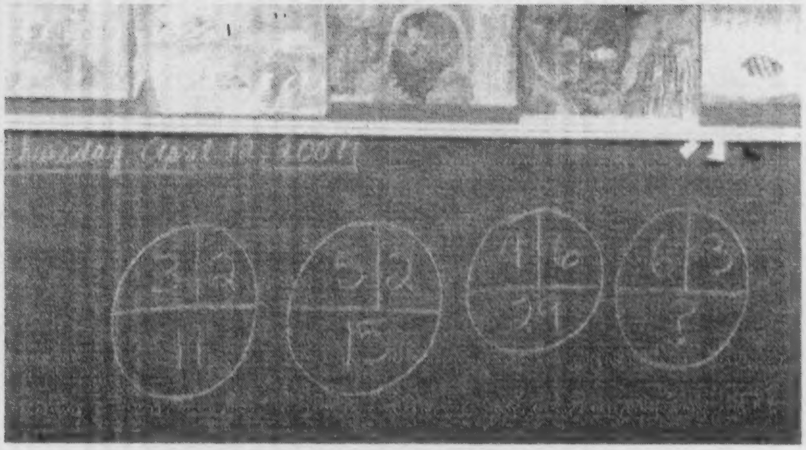

Figure 4: Karen's pattern

Students work for a while and then Karen asks for some of their answers. Several students give answers and then propose another step in the pattern. Karen asks students what sorts of things they have tried. This task is familiar to them and she does not need to ask them not to reveal the pattern. She then asks, "Who's got a pattern they think is harder than mine?" Emily raises her hand immediately and writes:

3 5 **23**	**6 6** **48**	**12 3** **?**

Students begin to answer: 12, 3 ⇨ 51; 5, 9 ⇨ 59; 5, 4 ⇨ 29; 5, 6 ⇨ 41. After lots of discussion and some tries at extending the pattern, Karen asks some students to explain how they have been finding the next number in the pattern. Someone answers that they have been multiplying the two numbers and then adding the two numbers to that product. Alex mentions that he did something different. Karen asks him to elaborate. He explains that he added one to each number, multiplied the numbers, and then subtracted one. Karen asks if it always works and he says yes. Karen catches my eye briefly. She says it is very interesting. While he talks, I madly write down some representations for both forms.

$$(3 \times 5) + (3 + 5) = (3 + 1) \times (5 + 1) - 1$$
$$(3 \times 5) + (3 + 5) = [(3 \times 5) + (3 \times 1) + (1 \times 5) + (1 \times 1)] - 1$$

I draw lines between the different parts to convince myself that the two representations are equal. I feel like I have been given a gift. Before Alex spoke, the mathematics seemed routine, easy, and mundane. I am excited by a new fresh way of describing the same pattern because at first I do not quite understand how it works. Being surprised by students' understanding of mathematics is energizing. It awakens wonder in my mind and heart, as well as my care for mathematics. As I meet Karen's gaze briefly, I am encouraged to keep thinking about the mathematics.

When Karen and I talk about this classroom moment, she shares that her way of getting to the next step is different from what Alex and I (and most students) were doing. She adds one to the second number, multiplies the two numbers, and then adds the second number again. As she thinks about Emily's question, she predicts the next number in the pattern. She makes her own sense of the problem as she comes up with a rule to describe the pattern. There is space in the classroom for Karen to care about mathematics too. Although she often shares her own thinking and strategies, she usually encourages students to share theirs first. Because it happens inside her head, Karen's relationship with mathematics is less evident than her relationships with the students, though it is still palpable.

Students sometimes tease Karen about her mathematical interest. Mariah tells me that she recognizes Karen's passion in the way that Karen talks about math in other subject areas, makes jokes about mathematics, and gives lots of work in math ("too much" says Mariah). Mariah cannot see what goes on in Karen's head, but she knows and feels that Karen has a close tie to mathematics. Mariah's own relationship with mathematics is strained, but she still tries to respond to Karen's tasks; Mariah cares for her teacher as she aligns her work with Karen's interests. This alignment is not always easy; the reciprocity is at times tenuous. Mariah deals with much frustration as she negotiates social norms about "intelligence," age, and fairness. Mariah has academic difficulties and is a year older than her classmates. She is keenly aware of her position and works hard to hide her school difficulties by focusing on social networking and fashion.

In response to Mariah's learning needs, Karen encourages her to use a calculator for basic addition, subtraction, multiplication, and division facts. As she gains experience using the calculator, Mariah's confidence increases. But other students take notice and express that it is unfair that Mariah uses a calculator to get answers that they try to work out in their heads or on paper.

In caring for her students, especially Mariah, Karen draws on her experiences as mother to four children. She tells students and me about her daughter, Anna, who visited the class on the occasion of Karen's birthday. She brought cake, Gerbera daisies, and soft drinks for a party at the end of the school day. Karen shares stories of Anna's travels all over the world, of her work as a roofer, and of her learning difficulties because of dyslexia. Karen shows us a wall hanging she has made. In the background of the fabric, Karen has added portions of e-mail messages she received from her daughter as she travelled. She describes the work that went into composing those messages. They are more than family banter and updates; Anna took hours to write and check those messages as she moved from one place to another. Karen reads the messages with a mother's heart and a teacher's care: she receives Anna's cheery words along with their underlying significance. The reciprocity of their care comes alive for me as Karen tells about how the two of them traversed the jagged landscape of public schooling to where they stand now.

Karen reads her students' work and behaviour using the same eyes with which she reads Anna's e-mail messages. When Mariah stalks around the classroom in the *day in the life*, commenting loudly on what others are doing, Karen reads Mariah's frustration with the task. She is sensitive in defending Mariah's calculator use. Sometimes Karen tells stories of her daughter's difficulties, such as when Anna spent all of winter break catching up on homework that she had not handed in because she did not think it was good enough for her teacher. This story is re-told at a time when Karen's students have not been completing their homework as faithfully as usual and when they are selecting their junior high school for next year. Karen's telling of her family stories is re-shaped by what is happening in the classroom.

The reciprocity involved in care is complex and changing. Mariah cares for Karen by working on her schoolwork. There is no indication that she is particularly interested in a task when she begins (though she does at times become engrossed as she works) but because of her relationship with Karen, Mariah engages in the tasks. When Mariah becomes frustrated, Karen responds by helping, by speaking privately with her, or by letting her figure it out for herself, depending on the situation. Karen and Mariah maintain a reciprocal caring relationship that is coloured with tension and inspired by Karen's relationship with her daughter.

As a way of describing the caring relationships Karen has with Mariah and Anna, I turn to found poetry (Butler-Kisber, 2002; Clandinin et al., 2006). The poem is created from words that Karen actually spoke (although pseudonyms replace the names). I have selected and juxtaposed pieces about Mariah and Anna that appeared in our conversations to bring forth the tensions of being both a caring mother and a caring teacher. Anna and her siblings are frequent ghosts in Karen's classroom. Despite having met Anna once, Karen's students sometimes ask Karen questions about her children that make it sound like the ghosts are very young, like them, and not the adults they really are. In our conversations (from which the words for this poem are taken), most of Karen's stories of Anna are stories from when she was younger but not quite as young as the students in Karen's Grade 6 class. In this composition, Karen's caring relationship with her daughter flows into her caring relationship with Mariah. The poem reflects the reciprocity at work in the back-and-forthness of the care.

Always On a Tightrope

Mariah
lots of trouble at school
big talk in the hall
wasn't a single thing I was doing that was suitable for her
frustrating

she's worried about going to junior high
special needs program
concerned that the kids in those classes get called retarded

goes back to, goes back to
my daughter
Anna
went to special classes
she did have to deal with those things
school was hard for her
reading and writing, terrible
eventually everything becomes a reading and writing test
misunderstanding
misinterpreting
good at math
she needed help, she's not stupid

sat in fear
didn't want to go to school
stomach ache
get through one more day

taking turns reading
counts how many are ahead of her
she's reading through to try and be prepared
girl in front not gonna read

panic
she's got the one ahead instead
panic

I don't know half the stories
spends a lot of energy making sure people don't know
exhausting
affects every part of life

pulled up to record on board
couldn't think
couldn't remember
couldn't remember how to spell
couldn't remember how to spell the smallest word
fear
somebody would see

my daughter's experience has certainly affected me as a teacher
if you go in a power thing you both end up losing
compassion for kids
advocacy
makes you see kids in a different light

always on a tightrope
Mariah
you go in there and pretend that I yelled at you the whole time

In the opening of the poem, Karen and Mariah are in the hallway, as in the incident in the *day in the life*. It is a private space for where Karen can listen to Mariah's frustrations about school tasks and her worries for next year. Karen apologizes for giving Mariah tasks that were unsuitable for her.

A ghost is with them in the hallway; Karen's daughter is present in spirit as Karen searches for ways to respond caringly to Mariah's learning difficulties and to her anxiety about the next school year. Karen is highly aware of the embarrassment that her daughter faced in school and how written assignments and assessments of Anna's learning generated deep fear and insecurity. Karen's stories about Anna reading out loud and being pressed into recording at the board speak to the way Karen gently encourages but does not push students to read and present in the classroom. The stories also evoke my own childhood memories of extreme nervousness and shyness in front of classmates. I too counted ahead when we read out loud in class and questioned my spelling at the board. Through Karen's telling, I can begin to imagine Anna's at-times-overwhelming fear. I can imagine how being Anna's mother has opened up new ways for Karen to care for Mariah and all her students.

Karen attends to academic and non-academic aspects of her students' lives as she cares for them. Karen tells me that Mariah was in a special class last year. She worked hard to move into a regular class. Mariah is outgoing and has a large group of friends. On my first day of meeting students, Mariah introduced herself and asked about my research project. Later, she slipped a note into my bag with her e-mail address on it. She loves to talk to her buddies about her favorite music and is very style-conscious, commenting positively on other girls' outfits. She always seems to have a friend nearby.

Karen knows that Mariah's friends are important to her. She understands why her own daughter hides her learning difficulties from those around her. Anna's stories of school resonate with what Karen knows of Mariah. She helps Mariah maintain a cover story (Clandinin et al., 2006) for her friends when she encourages Mariah to let the other students think that Karen was yelling at her for misbehaving so that she does not have to explain what she is really worried about: junior high. Karen, who is not known to yell inside the classroom, allows her teacher image to be shifted subtly so that Mariah's identity as a rebel can cover up her learning difficulties.

The tightrope that Mariah and Anna walk together is strung up between two worlds: the private and the public. As she cares for both of them, Karen helps to make that rope bridge a little wider, a little easier to walk on, a little less wobbly. In their care for her, Mariah and Anna allow Karen to be part of both of those worlds and to sincerely know them. The reciprocal relationships are challenging but rewarding.

Karen describes her relationship with mathematics as having reciprocity. She tells me that it is much easier "to teach the subjects that you care about yourself." Karen's passion for and interest in mathematics comes across vividly in her teaching. In the end-of-year interviews, her students consistently recognized Karen's care for mathematics. When I asked them to tell me about how they knew when a teacher cared for math, a typical response was to smile wryly and then describe some of the things Karen did in the classroom. Mariah said that Karen "talks about [math] even in health and [science] . . . makes jokes about it." Damian said "Mrs. Marks she makes math fun actually . . . like more fun stuff than just a worksheet . . . problems that the whole class can deal with." Caring for math gives something back to Karen: enjoyment of the subject matter coupled with the excitement of sharing it with her students.

Just as Karen draws on memories of caring for her children, especially her daughter, as she cares for her students, she also draws on memories of caring for mathematics. One challenge that I encountered as I began to think more deeply about caring both for people and for mathematics is that the former is visible while the latter is hidden. As I spent days, then weeks, then months, with Karen and her students, I knew that both forms of care were part of the way of life in Karen's classroom. Subtle touches, such as Karen's gaze or her explanation of her own thinking, unwrapped some of the layers that hide this care for mathematics. As Karen told me more about her mathematical and educational background, I began to think about her care for mathematics as being inspired by experiences in her undergraduate degree in mathematics and enacted through helping students engage in mathematics.

Karen's first degree is in mathematics, but she started out studying special education. As we sit across from one another in faded wingback chairs in the school library, she tells the story of how she came to teaching. Karen always liked math. In high school she was a volunteer at a school for children with special needs. She reveals that one of her professors asked, "Why do you want to be a special ed. teacher? You'll be wiping kids' noses for the rest of your career." She remembers that there was also a stigma associated with being in education and that people were surprised by her choice. As we talk, I am reminded of my own choice to enter the sciences many years ago. In the early nineties, there was a push for young women to go into the sciences in order to change the gender imbalance. Though I excelled in and enjoyed my studies in chemistry, physics, and mathematics, there was always something missing. I never felt at home in the laboratory and I was highly aware of the pressures of competition and achievement. I decided to try teaching and spent two years as a volunteer high school teacher before continuing my studies in education.

As Karen talks about switching her major to mathematics, I feel that her story is familiar but I try to listen openly to what she is saying. She reveals that although she is happy that she studied mathematics and found it to be a good experience, she feels insecure about the reasons for her choice. She says that part of the switch to math was to prove that "I can too do something else" in response to the stigma that she perceived around education. Later the conversation returns to family. Karen tells me that she is a teacher "just like my dad. Some things you just can't fight." His path to education was very different, as he first worked in the oil industry for a long time. After he completed his teacher training, which took a month, he began teaching. His monthly salary was equal to his bi-weekly paycheck in the oil patch. Karen continues, saying that a math background is not common amongst elementary teachers and that she really gets excited about math. Again, I am struck by the similarities in our backgrounds. I am a third-generation teacher and I too took a while to come "back" to education. I love mathematics. It is the subject I most enjoy teaching. The similarities between Karen's and my stories make it difficult for me to stay wide awake (Clandinin & Connelly, 2000) to how the care that Karen expresses has been shaped by her experiences without laying my own family plotlines on top of her story. It would have been easy to see my story in Karen's (or vice versa) instead of listening to her experiences and asking to hear more about what they mean to her. I tried to attend to the wholeness and distinctiveness of Karen's life, while considering the connections, but not the uniformities, between our stories.

Karen recounts that when he worked in the oil patch, her father spent weeks and sometimes months away from his wife and several children. Part of the reason for his decision to become a teacher was to be closer to his growing family. Like Karen, he faced opposition to his choice when his own father asked why he would leave a good job to become a teacher. Like her father, Karen chose education after trying something else, something she thought she ought to do.

In Karen's family there is a tradition of teaching and caring for family. As Karen lives out her version of this tradition, she draws on her care for her family to care for her students. She brings in her own care for mathematics as she supports students in exploring their mathematical thinking. The care she receives from her students and from their care for mathematics sustains her school and family life.

Proximity

In the preceding sections on profound attention and reciprocity, I draw inspiration from Noddings's work in order to explore how Karen cares both for her students and for mathematics. In relation to profound attention, I consider making sense and improvising as part of what it means for Karen to care both for students and for mathematics. Drawing on examples from the classroom, I elaborate on and extend Noddings's notion of reciprocity, especially with respect to caring for ideas. In this section, I continue to extend the boundaries for considering care. Proximity, though addressed only briefly in Noddings's work, is important to care in Karen's classroom. Guided by Noddings's emphasis on giving to and receiving "proximate others" (1984, p. 47) in a caring relationship, I delve into the idea of proximity as it pertains to care in Karen's classroom. Because proximity is not one of the characteristics of care, nor is it addressed meaningfully in the research and philosophical literature around care, this section is novel. It is shaped by Karen's work and by my understanding of an ethic of care.

Hannah is a quiet girl with a welcoming smile. Her classmates often turn to her for help with their schoolwork, but she is also popular for her interest in technology. In her year-end interview, she tells about how she and her family travelled across the continent to be with her ill grandmother. They stayed for six months and Hannah went to school there. They did what they could as Hannah's grandmother recuperated. Later, back at home, Hannah broke her leg. Her grandmother booked a flight for the next day. She came to help Hannah get better. The reciprocity is important, but so is the proximity involved as Hannah and her grandmother care for one another.

Other students also mention closeness. When asked to give an example of care, Sophie describes a time when she was at an amusement park with her sister and her sister's boyfriend. She said, "the Mindbender . . . that was the first time I went on it and I didn't want to and he just [said] 'it's okay, 'cause nothing will happen to you.' I was scared too the first time, you know, and then I just went on it. It was pretty good. And he sat beside me." It was important to Sophie that her sister's boyfriend was next to her and that he was willing to go through the experience with her. Emily describes another kind of proximity involved with care: "you just know that there's someone there." Though this could also be described as a physical proximity, Emily seemed more concerned that there would be someone to support her, a sort of emotional proximity.

In the classroom, I noticed Karen's proximity to students. When they work together, she sits or kneels next to them. Taking my cues from her, I also interacted with students by getting close without invading their personal space. In one picture (Figure 5), Karen is talking with Renee and Damian about some of their strategies for figuring out whether two dice games are fair. She is at eye level with them. She looks them in the eye and also looks at the mathematical task and work on the paper in front of them[27]. She speaks in a normal speaking voice, but she is speaking animatedly and directly to Renee and Damian. She looks at their faces and monitors their responses. She enters into a more personal relationship with them, one that I describe as a caring relationship. She responds to their questions and ideas semi-privately and immediately. Their proximity creates a physical, personal, and intellectual intimacy as Karen works to be close to them, to who they are, and to what they might be thinking.

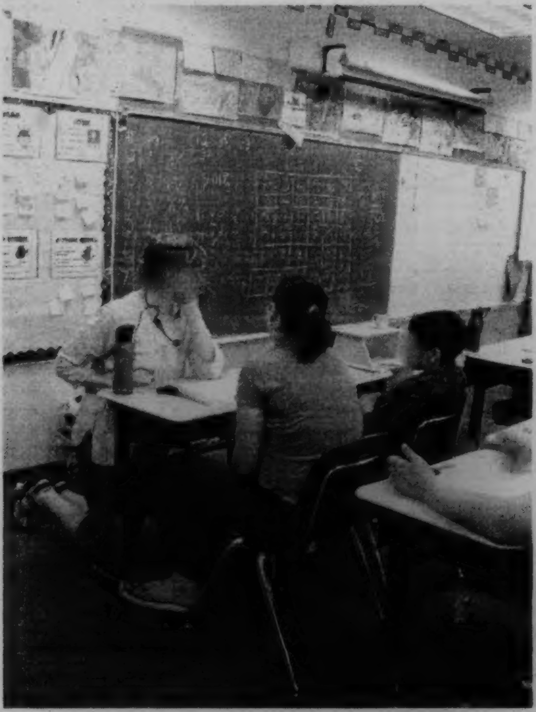

Figure 5: Karen working with Renee and Damian

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[27] David Wagner (2004) writes about students and teachers facing each other and facing mathematics in Chapter 6 of his dissertation.

Some spaces in the classroom are especially suited to being close to one another. One area, the C-table and carpet next to it, is used daily. In the *day in the life*, Karen, Renee, and Mariah sit at the C-table to work on a math practice problem. The table is at the side of the classroom, so all three can sit facing away from the other students. They have privacy to engage in the mathematics and try different possibilities for describing 100. The semi-seclusion and proximity support their care for one another and for math. Their choice of space creates intimacy as they trust one another enough to draw close to mathematics and to each other (Gordon Calvert, 2001).

Later in the *day in the life*, Karen uses the carpet next to the C-table for an improvisational demonstration with the golf ball and the ping-pong ball. Students are seated close together and close to Karen. They can easily see the two objects she drops. Being close together on the carpet allows students both to reconnect with their friends (they often sit together) and to be involved in the demonstration. There is both an emotional and a physical proximity as they enjoy being close to their friends. Profound attention is in rich supply, though not always directed toward Karen or to the science. Similarly, during art time the boys sit close together in a loose circle on the carpet. They share art supplies and talk about their favorite video and computer games.

Renee and a few others use the C-table as a place to be alone with mathematics. Renee reveals, "I get all mad and there's people distracting me, so I just go to the C-table." The table is a place where students can care for themselves as learners. There are few distractions as the students face away from the activity of the classroom. It is a place where Renee and others can attend profoundly to mathematics.

When Karen, Renee, and Mariah work together, when Karen demonstrates with the two balls, and when Renee is alone with math, there is an intellectual proximity as people in the classroom draw close to ideas.

The C-table and carpet are liminal spaces. They serve various purposes that are sometimes ambiguous. Karen and her students use these in-between spaces formally, informally, and improvisationally, sometimes all at the same time. In these spaces they shape and re-shape what it means to care with proximity. It is not always easy to be close, as when, at the end of the *day in the life* Mariah whispers to her friend and makes faces, distracting and annoying her classmates. Because she is so close, her actions are difficult to ignore. After students express their displeasure, Karen softens the criticism by acknowledging that Mariah has power in the classroom. She talks privately with Mariah about how things are going for her. It is not just about Karen being nice to Mariah, though that too is important. Because of their physical proximity, Karen sees Mariah's body language and guesses that she is upset. Karen responds with care.

There is something important about being close enough to look someone in the eyes and seeing that the look is being returned that sustains care: reciprocity in proximity. How can we do that with mathematics? How can a teacher show care (through proximity) for mathematics? One way is to keep mathematics *close* in the mind, to refer to it often or to invoke math in other curricular areas.

In addition to Karen and the students' physical, emotional, and intellectual proximity, there is also a mental proximity at work in the classroom, especially with mathematics. Karen often speaks about conceptual connections between math and other subject areas. She tells students how much she likes math. In science, art, and health, Karen mentions math. She also brings the other subject areas into mathematics. Karen deems one Friday to be "All-day Math." After some initial groaning, students get caught up in creating and answering math problems from newspaper articles and advertisements, trying a variety of mathematical tasks in a station-style arrangement, and creating quilts with geometric shapes as an art project. Karen jokes that she will try to convince the gym teacher to incorporate math into the day's lesson. Karen keeps math close in her mind and brings it forward in the classroom. One student jokes that Karen is "mathing" them.

The proximities and the liminal spaces that are part of everyday care in Karen's classroom become more important during a crisis. A teacher who has been on sick leave dies suddenly. In the hours and days that follow the personal announcement by the principal and vice-principal to the class, students nestle into their teachers' arms to sob. They sit close to one another on the carpet with their heads down.

As their grief unfolds, students and teachers look for ways to keep Mr. Walkins close to them. They share memories and pictures. Some write cards to his family, others linger around his old classroom. Physical, emotional, and mental proximities to caring others and to memories of care become essential.

I thought for a long time about whether to include the story of Mr. Walkins's death in my writing. It was a trying time for all people involved. Students did not always act caringly toward one another. There were mean words and some mild physical altercations. I relived painful memories of a time when one of my young students and her sister were killed in a car accident. I was *bouleversée*, overwhelmed, by their deaths. I no longer knew what to do in my classroom or how to help my students. I remember that we all tried to keep Victoria close by talking about her, sitting at her desk, and going to the funeral.

After Victoria died, my students wanted to be close to their own families, and so did I. Though we had lots of support, we were lost together in school for many weeks. One bright but still chilly day, I ditched the plan for the afternoon and we went outside on the baseball field just to play. We ran around, acted silly, sang, and performed *Ring around the Rosie* a few times. One student, Raphael, looked up at me with bright eyes and the first smile I had seen in a long time. Laughter spilled out of all of us. The experience was a turning point in my teaching. Though I had always thought of myself as a caring person and a caring teacher, I was heartbreakingly reminded of the primacy of human relationships.

It is not easy to care. Not for Karen. Not for me. Not for any person I know. My point is simple: it is difficult to care. Memories, plotlines, routines, images, roots, routes, ghosts, and expectations all shape the possibilities for care. The shaping and re-shaping of care need not be constricting. The tensions that live in our caring relationships can be sources for imagining new possibilities, just as Karen draws on her care for Anna to create ways of caring for Mariah. However difficult it is to undertake, caring is cherished in teaching. I believe that teachers can draw on care for students in order to bring care to subject matter. In the next chapter, I delve more deeply into how Karen and her students care for mathematics.

CHAPTER 5: MATHEMATICAL SITES OF CARE

In order to explore care in the context of an elementary classroom further, I draw on the field texts from my study. A number of experiences bear repeated telling and inquiry. I use three classroom moments to probe further into what it means for Karen to care both for her Grade 6 students and for the mathematics they encounter together. In Chapter 4, Karen's relationships with her students were the foreground and the mathematics was in the background. In this chapter mathematics comes to the fore.

In the way of life in Karen's classroom, the depth and complexity of care among the individuals begins to unfold. The profound attention, receptivity, and proximity of the one doing the caring are sustained by the response of the one being cared for. Caring for ideas is rooted in experiences of caring for people, though the response that sustains care for mathematics may be elusive or it may be blocked by the structure of the subject matter in the school.

An ethic of care can serve as a model for other forms of intellectual care. Profound attention, reciprocity, and proximity are also present as people care for ideas in other disciplines. But some aspects of care are of particular interest in mathematics. One example from the literature is that of equality. Tahta (1993) has described the work of Lusiane Weyl-Kailey, a French therapist and former mathematics teacher. At times, she worked with children on mathematics. Other times, they worked on family issues. In some cases, the mathematics and the family issues were linked. For instance, Weyl-Kailey worked with Theo on mathematical equality, which helped him "to face his family as an equal" (Tahta, 1993, p. 48). Mathematics can provide a space that may not be available elsewhere for thinking about and working through relational issues.

The field texts from my study present many aspects of care specific to mathematics, such as approximation and estimation, fairness, assessment of students' mathematical understanding, speed, and language issues. I focus on three aspects that reverberated across the field texts and across time: indifference, mistakes, and conjecturing.

I choose indifference and mistakes because I began to examine them before I entered the classroom; both seem to be important to mathematics in a special way. By this I mean that indifference and mistakes are also important considerations in other subject areas, but they seem particularly problematic in school mathematics. I also have personal experience with them as both a teacher and a learner. For these reasons, I introduce indifference and mistakes through my own memories of teaching and learning.

My fascination with conjecturing surprised me as I worked with Karen and her students. It seems important to explore conjecturing in mathematics in the context of care; there is care through the mathematics. So as not to spoil the surprise for the reader, the same surprise that I felt at recognizing care in the students' conjecturing, I leave further discussion of this third aspect for the end of this chapter.

I illustrate indifference, mistakes, and conjecturing with classroom episodes that I chose on the basis of my interest in the situation, their potential to engage the reader, and their promise in acknowledging the diversity within mathematics and the many ways of working in an elementary classroom. At the end of each episode, I revisit the experience by connecting it to research in mathematics education and to care.

Indifference

An ethic of care indicates concern and response; the two people in a caring relationship matter to one another. Some aspects of mathematics are consistent with *not caring* or *not mattering*. For example, if I write $3x + 4y = 48$ or $3s + 4t = 48$ and define my variables appropriately, it does not matter which expression I use; the two expressions communicate the same relationship between the variables. If I want to show my students an example of 3-digit addition with double regrouping, it does not really matter to me whether I offer 349 + 274 or 486 + 137. Both give the same answer and both have regrouping in the ones and the tens. The differences in the statements might *not matter* to the mathematics or to the teacher, but they may well matter to the student. Instances of indifference, also described as *not mattering* or *not caring*, are sites of interest for exploring care in the mathematics classroom.

Generalizations also have an air of indifference. They are valued in mathematics and in school mathematics. After 40 years, my father still remembers his quadratic formula, which can be called a generalization (or, even more strictly, a rule) for finding the roots of any quadratic equation. It does not matter much which numbers are "plugged and chugged" into the formula; the formula does not care, an answer will emerge. The same can be said of a theorem. For example, the Pythagorean theorem does not *care* which particular right triangle is being considered. The theorem holds true for *any* right triangle. in the plane

When I work with pre-service teachers of mathematics, we often look at questions involving patterns. Inevitably we find a multitude of ways to solve a problem, but when I ask, for example, how we could find the 511th (or the 512th, it usually does not matter in terms of the challenge involved) term of a pattern, the real work begins. The pre-service teachers have become intimate with (or proximate to) the early terms of the sequence. Though they have seen a pattern and have specialized by using several concrete examples, it is difficult to come to the generalities (the generalities are remote from the pre-service teachers' experience). I think of the general as being in profound connection with many particulars. Generalizations are powerful connections found through visualizing, observing, communicating, asking repeated questions, and seeking mathematical relationships. But generalizations are also indifferent. It should not matter which term of a sequence I am looking at; my generalization must describe it and include it.

There is also the indifference of people toward mathematics, used as a way of coping with subject matter that is not of interest to them. This sort of indifference may come when a person feels disconnected from mathematics because he or she does not understand concepts or it may come from a person's view of mathematics as a whole (as removed from real life, as indifferent, as boring, and so on). The indifference I examine in this study is the indifference that is part of mathematics, the indifference that is linked to generalizations.

Much of the work of care is based on the individual[28], not the general case. An ethic of care is in conflict with general rules and principles. How do teachers deal with this tension of caring for individual children in their particular contexts and caring for ideas in mathematics that emphasize generality?

Labelling Angles: My Account of a Classroom Episode

This first episode is a reconstruction of classroom events surrounding a student's question about labelling angles. I have used field notes and a detailed written account[29] to compose this episode in order to continue to bring forward the lives of Karen and her students and to highlight certain aspects related to care.

Once all the students have presented about their health projects, Karen invites everyone to the carpet. Alex arrives from the washroom just in time. She asks everyone to think about angles, which they have studied before. Nicholas and Alex define the different types. Then students show acute, obtuse, right, and straight angles with their hands. Karen introduces the reflex angle and uses her hands to demonstrate. She asks everyone to stand up and leads us in trying to show each angle with our bodies, with the waist as the vertex.

As we all take our places again, Karen writes each of the five terms on the board and chooses random sticks for people to draw an example of each. The right angle is drawn towards the left. Khalil says, "That's a left angle" and giggles. Karen continues to convey that in order to identify the angle, we put a dot at the vertex and an arc between the two rays forming the angle. Karen describes how to name an angle. She places a dot on each ray near the arrowhead. She explains that each dot is assigned a letter and the angle is labelled with an angle symbol, ∠, along with the letters, with the middle dot being the middle letter.

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[28] An ethic of care is rooted in relationship between individuals, especially those closest to us, though it does expand to include strangers.
[29] My use of accounts, informed by the work of Mason (2002), is described in detail in Chapter 3.

She proceeds by labelling each of the angles. When she labels the straight angle ∠ABC, Emily asks why it is called an angle when it is straight. Karen explains that it is part of the angle family and that it is still an angle. Emily, sitting at the front of the room, quietly asks a question. Karen interprets the question for the rest of the class; it is about why the symbol is an acute angle. Karen goes on to say that the same symbol ∠ is used no matter what kind of angle is being labelled; it is just a fast way to write "angle."

Karen notices that the Gerbera daisies on her desk are drooping and shows the students the angles made by the flower head and the stem. She goes through each type of angle. She then mentions that they will use a protractor to measure the acute and obtuse angles on a worksheet. She hands out protractors on transparencies. She reminds students to find the zero because there are two sets of measurements on the protractors. She says, "Remember how that drove you crazy, Emily?" As students begin to work on their sheets, Karen circulates amongst the students, who are working in groups of two.

Labelling Angles: Karen's Account

Karen's account of teaching the labelling of angles lesson resonates with my experience of the day and also with memories of my own teaching. I first presented my own recollections of the episode in order to help the reader get a sense of the context Karen considers in the account that follows. Though I present her words second, I do not consider them to be of secondary importance. On the contrary, her writing is at the very heart of studying care for people and ideas.

On Tuesday, we were discussing angles – acute, obtuse, straight, reflex. The students were drawing, measuring, and classifying angles. As Emily was working, she began to wonder why a straight angle is classified as an angle at all. Isn't it just a straight line? She asked me that question, and I wasn't really prepared (I should have been – it's natural). I tried to tie it to the point in the middle that marked that middle part of the angle (hmm, what's that called, anyway?) and that obtuse angles and reflex angles that are nearly straight are still angles. Actually, I'm not making sense to myself even now. Really, what I was expecting Emily to do was accept it because "I said so." In the same lesson, she wondered why this symbol (∠) is used to indicate "angle" even when the angle itself looks nothing like that. Another good question that I wasn't sure how to answer! The written language of mathematics has other examples of arbitrary symbols, and luckily for me Emily was willing to accept that that's just the way it is. I loved the fact that she was wondering about those things and asking those questions. She is clearly trying to make sense of the mathematical ideas and isn't satisfied to just take things on my say-so.

I often find myself thinking, long after a lesson is over, of all the things I could have done differently or explained better. Anticipating things ahead of time can help make that less of a problem.

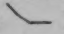
Historical Context of Labelling Angles

Here is an example of indifference in mathematics. The symbol for all angles is indifferent; an acute angle ∠ stands in for all angles. Emily's question about why the symbol used to label a straight angle is actually an acute angle (and not a straight line) spurred me on to find out more about the historical context from which this symbol emerged.

The symbol first appears in a 1634 series of elementary mathematics texts by the French mathematician Pierre Hérigone (Kennedy, 1989, p. 362). To denote an angle he used both the symbol that is now widely accepted, "∠", as well as the symbol "<", which had already been used for over a decade to mean *less than*. The first symbol endured despite a number of variations that appeared over the years[30].

How does this historical perspective help me to consider care in a mathematics classroom? In thinking about the history of this symbol, the conventions of mathematics become important. Mathematics educator and researcher Dave Hewitt distinguishes between the *arbitrary* and the *necessary* in mathematics curriculum. Mathematics can be viewed as arbitrary social conventions or as necessary properties that can be worked out. Conventions such as labels and symbols for mathematical ideas are considered arbitrary if "someone could only come to know it is true by being informed of it by some external means – whether by a teacher, a book, the internet, etc." (Hewitt, 1999, p. 3) while the necessary aspects of mathematics involve properties and relationships that a person can figure out based on what he or she already knows. Hewitt further distinguishes between arbitrary conventions and necessary properties by stating that the former lie "in the realm of memory" (1999, p.2) while the latter are "dependent upon the awareness students already have" (1999, p. 4). When I use the term *necessary*, I do not mean to imply that there is but one *necessary* way to interpret or solve mathematical problems. I use *necessary* to point to how humans have created mathematics with connections that follow some internal logic. Humans draw on our abilities to make sense of those connections and expand on them. Using the ideas of *arbitrary* and *necessary*, I re-examine Emily's questions and Karen's written account. I later return to explore care in these same contexts.

Arbitrary and Necessary

Emily's questions about why a straight angle was labelled with an acute-angled symbol, indicate that she was prepared to write |ABC so that the symbol matched the shape of the angle and reflected the difference in the type of angle. During the same class period and the next day's class, I observed students using  XYZ to label obtuse angles. Having spent much of their class time attending to the different types of angles, students counted on the notation being consistent with the differences they had studied. During the class period, there is a subtle shift in attention from classifying the angles to the notation[31] that is used to label them. The notation is general; it is indifferent to the type of angle being labelled.

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[30] For a remarkably clear compendium of the invention and use of mathematical symbols, see "The History of Mathematical Symbols" by Douglas Weaver and Anthony D. Smith, available at http://www.roma.unisa.edu.au/07305/symbols.htm.

One way to think about students' use of the unconventional (or invented) symbols is to frame the situation with ideas of what is arbitrary and what is necessary. Karen's students already knew a lot about angles, especially what they look like and the associated names. They had worked hard to learn the various types of angles, so they wanted the symbols to reflect and carry the understanding that they held. They drew on their knowledge of angles and of symbols in other areas of mathematics to imagine symbols for the different angles. They tried to work out for themselves the relationship between the object (the angle) and the symbol for that object. They looked for the necessary in the arbitrary. But the necessary and the arbitrary aspects of mathematics do not overlap, though they may be related. There can be no necessary in the arbitrary. Emily and her classmates bump up against the conventional symbols as they try to work out their own notation system.

Hewitt suggests that the essence of mathematics can be found in the necessary, in the realm of what can be "worked out or found out" (1999, p. 5). Though the angle symbol was created arbitrarily by Hérigone and accepted by the wider mathematical community, Karen's students worked at connecting their understanding of angles to different visual symbols for different types of angles. But the accepted symbol for all angles is still an acute angle. On my computer, only one symbol is available: ∠. It is a symbol to be learned and memorized, not one to be worked out.

Symbols are an important consideration in school mathematics. They merit further discussion. Skemp (1987) wrote about various functions of symbols. In his terms, writing |ABC or ⟍— XYZ can be described as "recording knowledge (and) helping to show structure" (1987, p. 46). Emily and her classmates worked on angles and used the symbols to make a permanent record of how they are named and labelled. In addition, the symbols showed the structure of the differences amongst the angles by using a different symbol to represent each type of angle.

There is something special about how close the symbols are to the objects they represent (the signified). Pictograms, as described by Pimm (1987), are "stylized icons in which the symbol is closely related to the meaning" (p. 141). The symbol looks like the object: □ for a square, ○ for a circle, and △ for a triangle. These three symbols are still general; they can stand for any object in that geometric class. The symbol □ can be used for any square as long as the letters that follow it identify the particular square in question. Emily and her classmates recognize the general nature of symbols and use an appropriate symbol to label any straight angle and any obtuse angle. But when Karen uses an acute-angled symbol to label a non-acute angle, Emily is perplexed. There is a "serious mismatch between the system of symbols which children are required to learn, and their own spontaneous representations" (Hughes, 1986, p. 78).

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[31] Though labelling angles is not one of the specific outcomes in the Alberta Program of Studies for Grade 6, the notation is part of what I would call the *understood* curriculum. Karen understands that notation is part of what it means to work with angles. In addition, this notation is commonly used in materials prepared by the local school district, including a worksheet students used later that afternoon.

This mismatch appears not only in geometric symbols, but also in other areas of school mathematics, such as the symbols used to represent operations on numbers[32]. In this case, Emily's pictogram is perhaps too much like the angle it is representing with respect to standard mathematical symbols. Students' invented symbols for the straight and obtuse angles are very specific and are consistent with the differences they have been attending to amongst the types of angles. However, pictograms, though they are visually like the objects they represent, must still be general enough to be useful as symbols. Imagine having to match the shape or type of angle (or other geometric shape) exactly when using a symbol. The usefulness of symbols for communicating with others and for working quickly and flexibly with the ideas that the symbols represent would be negated (Skemp, 1987). It is this generality, or indifference to the particular angle in question, that makes a symbol mathematically useful. Emily and her classmates use their visual and conceptual understanding to develop a coherent system for labelling angles. Though angle labels belong to the arbitrary world of mathematics, students in Karen's class draw on their experience of the necessary relationships amongst mathematical ideas to invent symbols that are consistent with their knowledge.

In this complex moment of teaching and learning, it is important to consider the subject matter. Looking at it in terms of the arbitrary and the necessary sheds some light on how mathematics is intertwined with the classroom context and the roles of teachers and students. Karen's account of labelling angles acknowledges the importance of the arbitrary as well as her understanding of her role as teacher in informing her students of mathematical conventions (though this role is not always easy). She values Emily's thinking as Emily tries to create connections to what she already knows. In other classroom interactions, Karen encouraged her students to work out necessary relationships by providing engaging tasks, asking questions, encouraging discussion, and supporting their thinking. Emily has learned that to do mathematics is to work things out and think hard. Karen tells her students how to label angles because it is a mathematical convention. But Emily sees the symbol and label for an acute angle as setting up a pattern for labelling the different types of angles, a pattern that reflects the differences she is attending to amongst the angles. She works out what she sees as the *necessary symbol* for the straight angle. Though, in Hewitt's terms, a necessary symbol is an oxymoron, in Emily's terms, it is exactly what she is working on. What Emily sees as a necessary symbol is actually an arbitrary convention accepted by the wider mathematical community. These arbitrary aspects of mathematics are *not* mathematics, but they might be described as para-mathematical or in the penumbra of mathematics. But even more is at work in this classroom. An ethic of care is also enlightening in considering the relationships among teachers, students, and mathematics. Through the arbitrary/necessary lens, the nature of mathematics is the focus. In the next section, I revisit Karen's account with care as the lens.

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[32] For more on the spontaneous symbols that young children use to represent number, addition, and subtraction, see Hughes (1986).

Care and Indifference

This moment of practice was a literal stopping point for the students and their teacher as they discussed and puzzled over the angle symbol. It is a figurative stopping point for me as I re-examine the moment through an ethic of care. Care involves entering into a relationship with another person or with ideas. Karen cares for her students. Aspects of her care are evident in the episode and account as she responds dynamically to students. She looks at them, paying attention to their verbal and body language. She plans tasks and questions for them. She improvises angle types on a Gerbera daisy. And the students respond by asking questions, sharing their understanding, trying out angles with their hands, drawing on the board, and listening attentively. Care takes many forms in this classroom.

For her part, Emily is working hard at her relationship with mathematics. She puts time and effort into understanding ideas. On previous days, she has shown perseverance in completing mathematical tasks and has willingly shared her insights. Response is valued in a caring relationship; Emily is giving to mathematics and has received something in return (pleasure, understanding, an *it makes sense* conclusion). In this case of labelling angles, the mathematics is not giving back; it is not responding as expected because Emily is working with the arbitrary. She spends much time categorizing and learning the properties of angles. She draws on that knowledge to imagine a symbol for a straight angle (|ABC) that reflects what she has come to know about it and about angles in general. But this conflicts with the symbol Karen uses, and Emily asks why this is so.

It is through the caring relationship that already exists that Karen responds to Emily's question. There is reciprocity, a back-and-forthness of care, as Karen takes the inquiry seriously and answers in different ways, watching Emily's reactions, monitoring Emily's response, and responding accordingly.

In this situation, Karen cares both for the student asking the question and for the mathematical content. When she hears Emily's question, Karen knows that her student is thinking mathematically. Karen takes for granted the symbol for angles, as it is a mathematical convention. Emily's query causes Karen to re-evaluate the symbol and the connection to what it is symbolizing. Karen writes, "[Emily] wondered why this symbol (∠) is used to indicate 'angle' even when the angle itself looks nothing like that." As she cares for Emily's mathematical learning, she can also be said to be caring for mathematics through Emily. Karen also works at caring for mathematics directly as she stops to think about Emily's question and enters into her own relationship with mathematics, though that entrance is veiled and is only evident in the slight pause in the rhythm of conversation between Emily and Karen.

When Karen and I discussed this incident later in a taped conversation, we noted that no one had ever asked either of us this question before in our (combined) decades of teaching. Even with all those years of experience, it was still complicated to care for Emily and her classmates while caring for the mathematics. In the moments that followed the unanticipated question, there were many things to consider: understanding Emily's question clearly, responding to Emily in a way that honours her mathematical efforts and her question, navigating the arbitrary and necessary worlds of mathematics, engaging other students (or not) in the explanation, using the examples on the board, etc. As Karen later put it, "Why do we do it that way? It sort of causes you to continually question what you know and why you know it and how you're going to try and help them know it."

Teaching is replete with these moments, but what makes this particular instance fascinating is that care for people and care for mathematical ideas are simultaneous and related in complex ways. In terms of the arbitrary and the necessary, I think that there is more possibility for a caring response from working on the necessary aspects of mathematics than on the arbitrary aspects. Both in the example in Chapter 4 with Khalil and measurement and in this account of Emily's questions about labelling angles, students receive something back from mathematics. Through her students, Karen also receives a response, a sense of pride in their learning and an opportunity to engage in her own mathematical work. The arbitrary aspects of mathematics, such as symbols and labels, have interesting historical facets, but it takes a different kind of work to receive pleasure (or pride or accomplishment) in this domain. The reciprocity that I see as being essential to caring for people is at work in caring for the necessary aspects of mathematical ideas. It comes with profound attention and work.

The indifference that is an integral part of mathematics is strongly tied, though not limited, to the arbitrary. I return to the account about Emily. When we label any angle we use an arbitrary symbol, ∠, and some letters. Emily did not know this and, as she was trying to work out what she thought of as the necessary symbol (based on the type of angle), the care that she put into her work was blocked by the arbitrariness of mathematical conventions and the indifference to context those conventions reflect. Because she had developed a caring relationship with Karen, Emily was comfortable enough to ask about this blockage. As a way of sustaining care for both Emily and for mathematics, Karen pursued Emily's line of questioning. Though to label a straight angle as |ABC would be considered a mistake in conventional school mathematics, Karen pays close attention to what is behind the symbol and what it means for Emily's understanding of mathematics. Her care is immediate, and it continues as she reflects in her account about what she could do differently.

The idea that what is necessary in mathematics gives something (generally something positive) back to students and teachers opens possibilities for planned curriculum, educational materials, professional development, and pre-service teacher education. The aspects of mathematics that are arbitrary, or that are taught or learned as arbitrary, offer a different experience from the mathematics that is necessary and based on relations within the subject matter. The arbitrary aspects offer no reciprocity for the student's effort to understand. It is still important for teachers and students to attend to the arbitrary aspects of mathematics, such as labelling angles, as these aspects can help people work more powerfully on the necessary aspects of mathematics. By caring for one another and for (necessary) mathematics, we can extend both our personal relationships and our relationships with ideas, just as Karen and Emily did in this account. Through both ways of caring, we can give and receive, feeling deep connections to one another and within ourselves.

Mistakes

Mistakes in mathematics provide another situation for examining care. How a teacher responds to a student's mistake[33] may reveal tensions around caring for the person who makes the mistake and caring for the ideas of mathematics. The teacher could respond by emphasizing what the student might have been thinking and by talking out loud about how it was a good strategy. This aligns with an ethic of care where the carer responds to the cared-for in a way that assumes the cared-for's best intentions. The teacher could ask the student to explain her reasoning. This response is in keeping with caring for the ideas of mathematics, especially those emphasized by the National Council of Teachers of Mathematics (NCTM, *Principles and standards for school mathematics*, 2000). In another scenario, the teacher might ignore the mistake. I can interpret this on the surface as a caring action (to spare the student some embarrassment), but I can also see it as not caring for the student's learning or for the mathematics itself.

Suppose the teacher points out the student's "careless mistake." There are at least two aspects of care to consider. First, I think about an ethic of care (for both people and ideas) within the context and relationship. But the word "careless" has an air of blame. This may be related to an ethic of care, as the teacher imagines an ethical ideal for the student and points out that the student has fallen short of that ideal. The word "careless" also implies that doing math requires care. What kind of care is required? Perhaps it is the sort of care that involves time, attention, and thought in a careful production. How does this caring *about* the finished product interact with caring *for* students and mathematical ideas?

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[33] Though it would also be important to look at mistakes from a student's point-of-view, especially with respect to their mathematical identity, it is not the focus of this study.

Researchers characterize errors in a variety of ways. Students and teachers can make mistakes in areas such as comprehension, reading, computation, concepts, procedures, and memory. Perhaps the most difficult type of errors for teachers and students to work on are conceptual errors. Students may associate images, procedures, and tricks with an erroneous concept. For example, crossing out the 6s in $\frac{16}{64} = \frac{1}{4}$ leads to a correct simplification of the first fraction (Meyerson, 1976). Another example with fractions comes from mathematics educator Stanley Erlwanger's work with a student called Benny. Erlwanger (1973/2004) observed Benny's consistent use and explanation of procedures. For converting a fraction to a decimal, Benny wrote: "$\frac{5}{10} = 1.5$, he said: 'The one stands for 10; the decimal; then there's 5...shows how many ones'" (Erlwanger, 1973/2004, p. 49). A student, having tried his or her own method, may think the method works for all fractions; he or she has tried to *make sense* of the idea. Exploring this sort of error can be mathematically rich; it could extend over several classes or encounters.

In the section that follows, I highlight mistakes in mathematics as I present an account of a typical morning routine of checking homework. I look at common mistakes (computational and procedural) that are explored easily with and among students, while maintaining mathematical interest. The ways that Karen and her students work on all sorts of mistakes is rich with care both for people and for mathematics. This account was written many months after leaving the research site, but I stayed close to my field notes.

Mistakes With Division: A Classroom Episode

The announcements come on and then Karen moves to the math check-up[34]*. She asks, "What if you and your partner have different answers?" Students advise using a calculator and doing it over. Karen suggests asking themselves whether the answer makes sense as well as finding out what went wrong. She adds that checking with a partner is helpful, but more important than changing the answer is finding out where they went wrong. She adds that this is like doing detective work.*

After students have been working on their division questions for a few minutes, Karen asks, "Did anyone make a mistake and figure out what went wrong?" Anne and Khalil raise their hands. Karen asks them to share the mistakes they made. They write the errors on the board and explain what they did wrong. Then they complete the operations correctly.

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[34] The math check-up is a short daily homework assignment that Karen began in the weeks leading up to the Grade 6 provincial assessment. The provincial test typically includes questions involving mathematical operations.

Khalil's mistake is that he found the wrong product, writing that the product of six and eight is 50 instead of 48. Karen adds, "If you're close to the actual answer, it might be a mistake in basic facts." Karen asks students to suggest strategies for basic facts in case they cannot remember an answer like 6 × 8. Students share a few strategies, including using a close multiplication and then adding (or subtracting) groups.

Anne explains that she knew hers was wrong because she saw that Sophie's answer had no remainder and that her own subtraction answers went up instead of down. Karen points at Anne's corrected division and says that you could save time with seven times twenty instead of seven times ten and seven times ten. With a positive tone, she adds, "Anne's gone with what she knows easily." Karen calls on Sophie, who has done it differently using a more traditional method, to write her solution on the board and explain it while Karen checks homework.

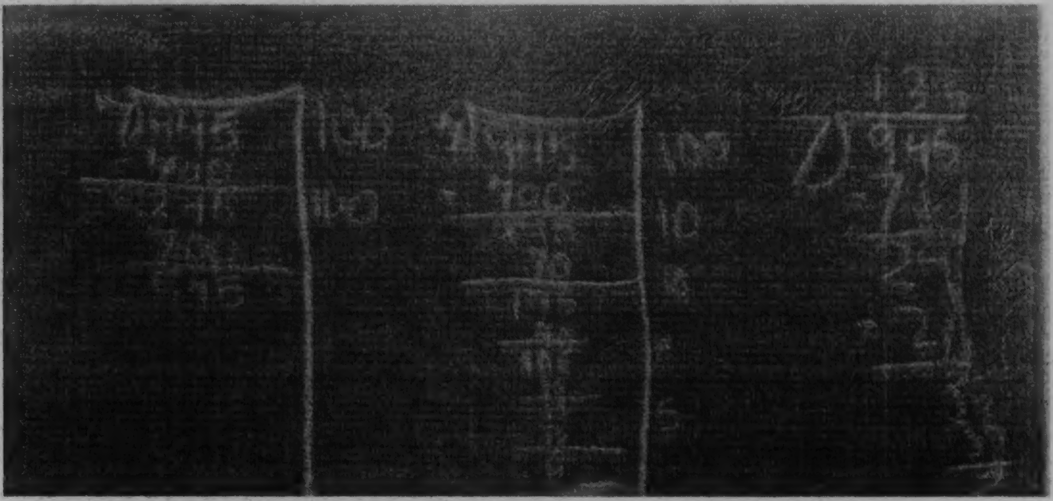

Figure 6: Khalil, Anne, and Sophie's work on their mistakes

This account from Karen's classroom is one of many similar occurrences. The taken-for-grantedness with which the students and Karen enter into these discussions speaks to the care they have for one another and for mathematics. Mistakes like the ones that Khalil and Anne shared with the class could have been dealt with differently. When I was an elementary school student, my teacher might have circled my mistakes in red ink and left them for me to correct. Or, I might have had to take the check-up home again to work on my errors. In both cases, I might have come to a better understanding of the mathematics involved, but I might also have spent many frustrating hours trying to figure out what was wrong. This is not to say that working alone might not be a useful exercise and a learning experience, but in Karen's classroom there is space for working both alone and with others, just as there is space to care both for people and for mathematics.

To begin to unpack this classroom episode on mistakes, I first consider the more general context of mistakes in mathematics. This context serves as a backdrop for highlighting care in Karen's classroom; it provides both contrast and similarity to the ways in which Khalil and Anne work on their errors. Then I examine in more depth the interplay between care and mistakes in Karen's classroom.

Mathematics and Mistakes

Rafaella Borasi (1996) has explored mistakes as "springboards for inquiry" (p. 209) and the potential for errors in mathematics to "stimulate mathematical explorations and reflections on the nature of mathematics" (p. 209) in the classroom. Instead of viewing errors as failure on the part of the teacher and/or the learner, Borasi invites mathematics teachers, students, and educators to capitalize on errors as rich sources for mathematical learning, a view that describes a congruity of caring for people and for mathematical ideas.

Borasi also describes how considering mistakes as opportunities for learning is both an old and a new idea. She writes about four historical examples of how errors helped the discipline of mathematics to grow as mathematicians engaged in inquiry into mistakes. Errors, she argues, are fundamental to mathematical inquiry and learning. In an era of reform-oriented curricula, errors may be regarded as productive signs of mathematical thinking (Eggleton & Moldavan, 2001; Fiori, 2007; Lannin, Arbaugh, Barker, & Townsend, 2006; Martinez, 1998). Borasi details a number of ways of using errors as the impetus for further mathematical study in the classroom.

Many people have "negative feelings" (Borasi, 1996, p. 3) toward making mistakes in mathematics because of the emotions involved (shame, disappointment, frustration) or the consequences (lower mark, reprimand, do-over). I think of the character Christopher, who has autism, in Mark Haddon's novel *The Curious Incident of the Dog in the Night-time*. Christopher attributes mistakes to over-reliance on intuition and finds solace in the rightness of mathematics: "Intuition can sometimes get things wrong. And intuition is what people use in life to make decisions. But logic can help you work out the right answer" (Haddon, 2002, p. 65). With this view, mistakes are a failure of logic. Much of the research in mathematics education on mistakes or errors focuses on the "diagnosis and remediation" (Borasi, 1996, p. 3) of students' learning difficulties. Though this type of research is worthwhile, researchers who engage in it do not necessarily view mistakes as learning opportunities for the student, his or her classmates, and the teacher. Textbooks often present the work of mathematicians and mathematics educators in textbooks in finished, polished form with no mistakes. There is a strong social message in many educational structures (marks, testing, textbooks) that mistakes are a sign of intellectual weakness or failure.

Teachers, students, and their families receive these mixed messages about mistakes. The messages are ghosts in our classrooms. My own ghosts come in many forms. I can still hear the refrain of a Sesame Street song from my childhood in which Big Bird sings, "Everyone makes mistakes, so why can't you?" I remember having a very large eraser that stated: "I only make BIG mistakes." Though I can claim to have a joking, healthy attitude towards mistakes, I can also claim the opposite, remembering hours of labouring over my work in order to get it just right. A sense of pride and accomplishment comes with getting things right. These are all important ghosts. They speak of a willingness to laugh and accept mistakes as part of serious, diligent work. But I think it is also important to tell other stories of mistakes, especially caring classroom stories, in order to expand popular views of mistakes in mathematics.

Care and Mistakes

Vivian Gussin Paley (2006) writes about the errors that her kindergarten students make with regard to number and measurement. Much of the children's sense-making for questions around the twenty-two apples in their classroom was linked to being able to touch the apples or use their fingers as they counted. They made some mistakes below ten, but past ten the errors increased significantly and they used numbers "indiscriminately" (Paley, 2006, p. 45).

Mistakes are closely tied to making sense, an idea discussed in Chapter 4. Recognizing the sense that her students were trying to make as they used names they knew for big numbers to indicate *bigness*, Paley put away the printed numbers labels on each apple and worked on questions similar to those that had brought forward the mistakes. As students relied on their honed sense-making abilities (such as touching the apples and counting out loud), they were able to answer the questions correctly. Student mistakes can be, as Borasi contends, a springboard for student inquiry, but they are also precious reminders of what learners are trying to know and what they understand, if a teacher like Vivian Paley or Karen is willing to look at those errors as possibilities for teaching and learning. Taken at merely in the context of diagnosis and remediation, errors can mean particular ways of planning or presentation. But a teacher who looks at the mistakes sideways, as an expression of a learner's sense-making and as a productive part of mathematical inquiry, can create different ways of being in the classroom.

As she invites students to look at their work and their mistakes, Karen shapes what it means to care for mathematics. She reiterates the primacy of "making sense," a form of care, as she recognizes that they have been working on mathematics and that they are able to re-evaluate that work by drawing on their knowing of mathematics. She describes the importance of finding errors but also of analysing wherethose errors come from. Karen likens the experience to detective work, a topic her students have been studying in science. She asks them to work in pairs. Because of past experiences, students have expectations about how they work with one another and with mathematics. Karen draws on their shared classroom understandings in order to shape an ethical ideal of caring both for one another and for the mathematics at hand.

As Khalil talks about his mistake and makes his correction, Karen capitalizes on the opportunity to talk about strategies for mental calculation. She draws other students into thinking about what they can do to correct errors in multiplication. As Anne presents her error, Karen listens intently as a way of acknowledging Anne's sense-making about the subtraction of whole numbers within a division. Afterwards, Karen points out a more efficient way of solving the same problem while still honouring Anne and Sophie's correct ways of dividing.

The types of mistakes that Khalil and Anne share are not earth-shaking from a mathematical point of view, but the episode shows ways of being with mathematics in Karen's classroom. Mistakes are part of what it means to do mathematics; they are a serious consideration without being high-stakes. Karen pays deliberate attention to errors in the context of students' work, not as a topic separate from their mathematical inquiry.

Noddings describes an element of care where the carer receives the one being cared for; it is a "feeling with" (Noddings, 1984, p. 30) the other person. In this episode involving Khalil and Anne, Karen attends profoundly to the work that they have done on the math check-up. By asking them to discuss their findings with a partner, she acknowledges that their work was worthwhile; she is receptive to their emotional need for recognition. At the same time, she is receptive to the "needs" of mathematics and to the students' needs as learners as she asks them to look carefully at their own work and to reflect on any errors they find. Karen is feeling with her students and caring for mathematics in this and many other similar situations in their shared classroom.

Though Borasi does not directly address care, I read Borasi's writing as being sympathetic to Karen's ways of working with errors. Citing Yackel and her co-authors, (1990), Borasi writes that when a learner makes a mistake, "it is especially important for the teacher to assume that the child was engaged in meaningful activity" (1996, p. 42). Karen makes that very assumption in response to students' emotional needs; it is a form of caring. Noddings also describes caring as ascribing the best intentions to the cared-for. Karen shows that she believes her students worked at the mathematics and are able to reflect seriously about their own learning; she cares by presuming the best about them.

Borasi (1996) also makes the point that it "is unlikely that students will be willing and interested in spending the considerable time and effort necessary to pursue a study of their errors, unless they expect such activity to be worthwhile and rewarded" (p. 6). At times, students receive positive attention for mistakes they have made. In the classroom, the care that Karen shows for her students is part of the reward and the worth of doing mathematics. The students receive something positive in the reciprocity of their care for mathematics. In this and other classroom episodes, Khalil receives the pleasure of using understanding from other areas (such a work on multiplication) to help him with new tasks (such as division). As she notices the pattern of subtraction answers "going up," Anne comes to a correct solution by relying on her own sense-making; she gains satisfaction in this pursuit. Anne's care for mathematics is rewarded as she is able to find and then explain her own error.

Despite all these similarities between caring for people and caring for mathematics, an important difference also comes forward in this episode. Making mistakes with people and making mistakes in mathematics have contrasting repercussions, though Karen imbues both situations with care. In Chapter 4 I describe how Aidan is bullied on the playground at recess and then acts aggressively toward one of his classmates in the hallway. Karen takes time to talk to Aidan and a few other students individually. She then calls a class meeting to talk about what happened and to discuss more caring reactions. The way that his classmates treat Aidan outdoors and the way that Aidan treats Josh indoors could be called *mistakes*.

Making mistakes with people can leave deep marks on the psyche (and body) and may escalate into more serious matters. Errors in mathematics might also have very real, even physical, repercussions; think of calculation errors in engineering that result in a bridge collapse. In school mathematics some repercussions for errors might be a sense of inadequacy that affects a student's self-image or a failure to achieve a level of performance that is socially important in the classroom (getting a star or sticker or progressing to a new type of test or group). In Karen's classroom, mistakes do not seem to be physically, mentally, emotionally, or socially catastrophic. Although students tried to avoid making mistakes and sometimes hid their mistakes from classmates, there were safe spaces, public and private, in which they could make and work on mistakes.

The relational care that is required between people is qualitatively different from the care needed for doing school mathematics even though making mistakes within both types of care may have repercussions. Relationships between people are immediate and they unfold over time. They involve reciprocity and a *feeling with* the other person. Karen evokes an ethic of care when students deal with both mistakes with people and mistakes with mathematics. In the class meeting, Karen takes time to listen to what her students are really saying while she improvises on the situation to invite them to reflect on what it means to care for one another. The same could be said for the episode with Khalil and Anne as she listens to their words and reads their written work while inviting all students to care for mathematics.

There is another significant difference between caring for people and caring for ideas. Though there may be a feeling of response when a person cares for ideas, the possibility for the ideas to care for the person does not exist as it does in human care. Ideas cannot reciprocate care in the same way that people can. I cannot parent an idea as I might parent a child, in the hope that it will care back for me as it grows. I cannot teach an idea as I could teach a student and look forward to seeing the idea pursue its own interests in response. An idea cannot stand in the place of a person and give care. This is where the qualitative difference between caring for people and caring for mathematics originates.

When I enter into relational care with another person, that person's world, thoughts, and feelings become important to me. Mathematics may well be "a world which one enters" (Mason, 1991, p. 84), but the subject matter does not have thoughts and feelings that I can care about. In a larger sense than in the labelling angles episode, mathematics is indifferent. As a subject, school mathematics does not *care* whether or not a student makes mistakes; there will be no negative consequences from the mathematics. But a teacher and students can create a caring atmosphere of serious study of mathematically stimulating mistakes coupled with a healthy acceptance of inevitable errors that can be corrected. The indifference within mathematics can be considered a strength if school mathematics provides a safe place to make mistakes, to deal with frustrations in a healthy way (Tahta, 1993), to persevere, and to care.

Karen works hard to create this safe mathematical space within a caring classroom atmosphere. Part of this work is to receive the students as they are, with the mistakes that they make, and to respond with encouragement while helping them to imagine how they might correct errors or think more deeply about them. Karen cares for her students individually while still sparking an ethical ideal. This hard work leads to tensions, such as with Mariah, and congruities, such as the parallels between attending to Khalil and Anne's mistakes and to dealing with students' bullying of Aidan. But it also leads to some surprises. In the next episode, I turn my attention to an episode involving Aidan and Thomas. Their mathematical conjecturing within a simple game came as a great surprise to me as did the eventual connections that I noticed between conjecture and care.

Conjecturing

Conjecturing About Probability: A Classroom Episode

Karen announces that students will play another game with dice, indicating that it is a competitive one ("everyone's favourite"). It is a game of odd versus even. In pairs, students have to decide who will play for odd and who will play for even. She explains that a point is scored when two dice are rolled and the sum is even (or odd, depending on each partner's choice at the beginning). The first player to score ten points wins. They are to play as many games as possible. Karen says, "What I want to find out is if this game's fair." Anne says that there are more odd than even numbers between 2 and 12. Karen lists them orally, counting on her fingers: 2, 4, 6, 8, 10, 12 and then 3, 5, 7, 9, 11. Alex adds that seven won in yesterday's similar game, saying that there is more chance for odd. Students play several games.

Karen keeps track of the wins on the board. After several rounds, she asks, "What's your gut feeling? Is it fair?" Students say, "Yes!" When some students *play with their dice, Karen says that the hardest job will be to hold onto the dice. When one die escapes, Karen smiles and says that she will hold onto it, adding that it is a "naughty" die. The students smile too. She continues, "Let's go back to our game. How would we find out the probability for odd?" Students help to set up the fraction 21 (the number of odd wins) over 41 (the number of trials). Karen asks, "Who's got a calculator to find the experimental probability?" Several students call out, "Fifty-one percent." Karen asks, "Would you say that game is pretty fair in our test?" Students agree that it is. She continues that a small sample (only four or five trials) might give a bad result since at the beginning there were 4 odd wins and 1 even win. She asks, "How would we find out for sure?" Samantha shares that the students could "switch" even and odd back and forth with their partner. Karen expands on that answer, adding that they could also list the various sums as they did yesterday.*

Karen says they will play another game that is very similar. They will multiply the numbers instead of adding them. As they begin to play, Aidan says that even will win every time. He starts listing products. Karen listens intently. Then Aidan says the chances are the same because 1, 3, 5 are odd and 2, 4, 6 are even.

As students continue playing, Karen records the results on the board. Karen and I circulate amongst the groups. Aidan continues, "Odd can barely win." He states that anything multiplied by 3 will give "purely odd." When I ask about 3 × 2, he revises. Thomas comes along and says that only 1 × 3 wins for odd. I share that Aidan found others. Aidan says that 1, 3,or 5 times 5 give odd. He and Thomas talk back and forth from their respective positions with different partners.

Karen calls for everyone's attention. When she asks if the game is fair, they say "No!" Karen says, "How many of you were thinking about why it isn't fair while you were playing? I know Aidan was doing a lot of thinking."

On the board there are 17 even wins and only one for odd. Under "Experimental Probability," Karen writes the fraction 1/18 ("odd wins/trials"). Karen comments, "If your game is almost *fair, it will take a lot of trials to notice. But if it's really unfair, you notice right away."*

Aidan then shares his thinking with the rest of the class: 1, 3, 5 times 1, 3, 5 will give odd. Karen adds, "You said earlier that 2 times anything will always give you even." Thomas and his partner Josh are talking and have already been reminded to listen. Karen says to Thomas, "I need you to turn around because Josh needs to listen and he won't if you are talking to him. I need you [Josh] to listen too." She continues, "This can help if you are struggling with times tables: You will only get an odd product when it's odd times odd." She reminds them of the tree diagram she drew yesterday and draws a new one.

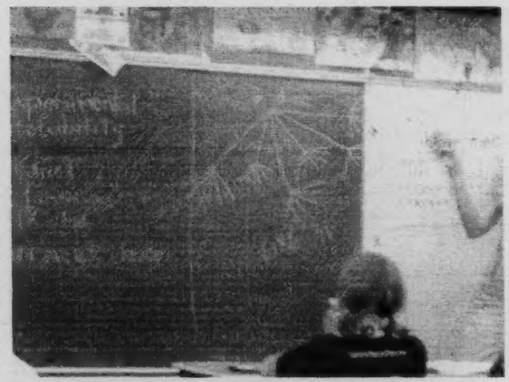

Figure 7: Karen's tree diagram

She points to the six branches and says that they each have six smaller branches. She asks how many possibilities there are. Students answer 36 and Karen writes, "6 × 6 = 36." She begins to show which of the possibilities are odd, but students remind her that they need to share their work from social studies. Karen brings down the screen and a few students present before recess.

In this classroom episode about probability, Karen has made space for conjecturing. Aidan and Thomas share their conjectures with one another and explain their thinking. They refine. Karen and I listen to what they say. We notice and respond to their mathematical thinking. They listen to the questions we ask. No one tells the *right* answer and it is not obvious. Students play with the evenness and oddness of multiplication.

As I look through my field texts, I see many examples of students conjecturing, but this particular episode opened my eyes to the importance of conjecturing in mathematics and how it is connected to care. Part of what surprised me was that Aidan began to voice his ideas out loud and then revised his conjectures as he and his partner kept score. Though it was not uncommon for Karen's students to think out loud, Aidan seemed to direct his comments to Karen in particular. She had shown that she cared for mathematical ideas and was free to listen attentively. I was surprised again when Thomas, with little prompting, took up Aidan's conjectures and added his own as they thought out loud to one another across the metres between them[35]. At other times I saw students taking up one another's ideas and working on them together, but usually the students were good friends. Aidan and Thomas were not particularly good friends. Though they sat next to one another regularly in computer lab, they rarely chatted, focusing instead on the screen or on their own buddies.

I was also surprised at how the conjectures got clearer as Aidan, Thomas, and their partners played the game, fed one another information, and voiced their thoughts. Their ideas got swished around, moved faster, and got narrower, as water does in a draining sink or a funnel. While Karen and I began by encouraging students to conjecture, Aidan and Thomas were soon engrossed in thinking and expressing their thoughts to one another about what could be happening in the game and why.

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[35] For another example of what I call students caring for ideas with one another in a mathematics classroom, see Houssart (2001).

When Karen and I later discussed this particular episode, she too mentioned the narrowing of the ideas as they worked on the game. She went on to tell me that, though she knew things went well during that particular class, she is often frustrated when she tries to create a conjecturing atmosphere and it does not happen. "It's hard. I mean, sometimes they just get into that space. And if things are working really well, and then you know, the next time that you'll feel like you have it structured so it's going to happen again and it doesn't happen." She talked about how she reflects on what is different each time and how she might use that understanding in the future. She said that the task is very important and that it has to feel "doable" to the students while still offering a challenge. While I agree wholeheartedly with Karen's emphasis on using rich tasks, I also know that the care that is evident in her classroom emanates from more than the tasks that she sets. The tasks are one way of caring both for her students and for mathematics. But there are other ways, such as when she reminds Thomas and Josh to listen or when she listens to Aidan's conjectures.

In the next sections, I examine conjecturing in more general terms; it is like zooming out with a camera lens to see the broader background behind the subject at hand. Then I return to Aidan and Thomas's conjecturing in Karen's classroom and connect conjecturing to care. It is an invitation to see the people in Karen's classroom "big" (Clandinin et al., 2006). That is, I examine the unfolding, particular lives of Karen and her students against the backdrop of broad contexts that shape education and school mathematics.

Conjecturing, Mathematics, and Care

The idea of conjecturing as an integral part of doing mathematics is not new, but it came to the fore first in George Pólya's classic book *How to Solve It: A New Aspect of Mathematical Method* (1945) and later in Karl Popper's *Conjectures and refutations: The growth of scientific knowledge* (1968).

Pólya (1945), a mathematician and mathematics professor, wrote about heuristics that people use to solve problems, such as finding patterns, using models, and guessing-and-checking. *How to Solve It* has been translated into many languages and was most recently reprinted in English in 2004. Cited in Mason and Johnston-Wilder (2004), Pólya wrote about conjecturing:

> First, we should be ready to revise any one of our beliefs.
> Second, we should change a belief when there is a compelling reason to change it.
> Third, we should not change a belief wantonly, without some good reason. (p. 140)

This passage brings to mind the way that Aidan conjectures about the probability game. He starts with one conjecture but is prepared to change it as he plays the game and understands the game better. He changes his conjecture that anything multiplied by three will give an odd product because there is a compelling counter-example, not simply because it is an adult (me) who provides the example. Similarly, Thomas changes his initial conjecture that only 1 × 3 could win when Aidan provides convincing information from his game. Conjecturing, in the form that Pólya has described and in the ways that Aidan and Thomas bring it to life, is an essential part of the mathematical classroom.

A former secondary school teacher, Popper was an influential philosopher of science. In his preface, Popper ties conjectures to learning from mistakes. As I read his work, I begin to see how so many of the ideas that I have explored are connected to one another and to my own experiences as a student and teacher of science and mathematics. An excerpt from Popper's preface reveals many of these connections. I wish to emphasize that Popper's writing is not a central inspiration to my work or to my epistemological stance, but that it has shaped my teaching and learning of mathematics.

> The way in which knowledge progresses, and especially our scientific knowledge, is by unjustified (and unjustifiable) anticipations, by guesses, by tentative solutions to our problems, by *conjectures* . . . Criticism of our conjectures is of decisive importance: by bringing out our mistakes it makes us understand the difficulties of the problem which we are trying to solve. This is how we become better acquainted with our problem, and able to propose more mature solutions: the very refutation of a theory — that is, of any serious tentative solution to our problem — is always a step forward that takes us nearer to the truth. And this is how we can learn from our mistakes.
>
> As we learn from our mistakes our knowledge grows, even though we may never know — that is, know for certain. Since our knowledge can grow, there can be no reason here for despair of reason. And since we can never know for certain, there can be no authority here for any claim to authority, for conceit over our knowledge, or for smugness." (Popper, 1968, p. xi-xii, italics in original)

Though Popper wrote mainly about scientific knowledge, this passage brings me back to Karen's classroom. There is something hopeful yet still tentative about the ways in which she and her students care for mathematics. They use mistakes and conjectures to explore unfamiliar mathematical terrain, while being open to the possibility that the explorations will deepen and reshape what they already know. Reciprocity lies in the openness to and the possibility of change.

I am also reminded of the uncertainty that permeates Karen's classroom; it is a certain kind of uncertainty and it is different from Popper's meaning. It is not the uncertainty of not knowing whether the teacher will ignore you or care for you as a student. It is not the uncertainty of pop quizzes and putting people on the spot. Rather, it is an uncertainty related to curiosity and possibility. Karen responds with improvisation to students' interests, actions, and ideas. The uncertainty comes from the sheer complexity of what Karen and her students bring to the classroom: their lives, stories, ghosts, ideas, moods, and much more. These are all part of the curriculum in Karen's classroom; students and teacher all recognize each person's unfolding life. Care is at the heart of receiving and responding to the whole of each person.

The passage from Popper also strikes a chord with regard to authority. In the episode with the probability game, Aidan acknowledges Karen's expertise in mathematics as he addresses her first. But the authority in the classroom is shared as he includes others in his conjecturing: his partner, me, and especially Thomas. In this sharing, caring for mathematics is something that we all do, that we all can do.

Imre Lakatos was a philosopher of mathematics and science whose work was profoundly influenced by Karl Popper's ideas. Lakatos also recognized the importance of conjecture. In his book *Proofs and Refutations: The Logic of Mathematical Discovery* (1976), Lakatos "uses characters in the book to represent historical schools of mathematical thought to provide us with a collective historical progression of the arguments surrounding Euler's Conjecture" (Atkins, 1997, p. 150). The arguments are in the form of a dialogue between teacher and students (with extensive footnotes). The book begins with a problem and a conjecture. The rest of the dialogue consists of the arguments around the conjecture.

Lakatos imagined a different way of teaching, learning, and doing mathematics. Instead of relying solely on proving in a formal sense, Lakatos emphasized *im*proving conjectures. As Aidan and Thomas clarify their conjectures, they improve them. Aidan revises his initial conjecture after thinking about my counterexample. As they play the game, they both refine their thinking and come to a better understanding of what it is that they are exploring.

It is relevant that Aidan and Thomas are involved in playing a game. Janet Ainley (1988), a researcher and teacher educator in mathematics education with a background in elementary teaching, writes about the role of games in stimulating conjecturing: "In other situations, children are often unwilling to try out ideas unless they are sure that they are correct, and so do not naturally make conjectures. They may associate *modifying* a conjecture with admitting to having made a mistake. Within a game, conjecturing is both natural and safe" (p. 245, italics in original).

Though the episode I explore here is about a probability game, Karen and her students made conjectures all the time. This speaks to the atmosphere that she and her students created in the classroom. In their care both for one another and for mathematics, they forged relationships that made them feel safe and confident enough to conjecture about mathematical ideas and to make mistakes. It was through this particular game that I began to attend to their conjecturing. The intensity and excitement of the situation triggered me to notice and caused me to reflect on the many other instances of conjecturing in the classroom. After the conjecturing, Aidan articulates thinking about multiplication that caresses a generalization: an odd number times an odd number gives an odd number. Karen points out how the information Aidan shared could help students in their everyday use of basic facts. She brings this forward especially for Josh, who has difficulty staying focused on academic tasks.

By zooming in and out between conjecture in Karen's classroom and in the wider mathematical milieu, I draw attention to the work of care. As a teacher, part of what Karen does is to zoom out from her particular students' lives, ideas, and personalities to general mathematical concepts, prescribed curricula, and the mood of the class (or even school) as a whole. As a teacher, there is eternally something else to do: marking, planning, preparation, paperwork, professional reading, and more. Karen manages all of these things while still being present to her students.

I am reminded of a wordless children's book titled *Zoom* (Banyai, 1998). The first illustration is a close-up of something, but that something (a rooster's comb) only becomes clear when I turn the page to see the next illustration. Each successive picture shows a little more of the big picture; each illustration occupies smaller and smaller portions of the successive pages. The work of care is a bit like flipping back and forth amongst the pages of this book, zooming in and zooming out, looking for ways to care both for students and for ideas, seeing the people *big* while still attending to subject matter and to ethical ideals.

In this episode, Aidan and Thomas receive something from mathematics; it is evident on their faces, in the tone of their voices, and in their excitement and understanding. Noddings writes that the joy and receptivity of intellectual work takes place during occasions "in which the student and the subject matter meet without prestated objective and in which the subject speaks to the student" (Noddings, 1984, p. 146). She argues that this joy "accompanies our recognition of relatedness and reflects our basic reality. Its occurrence and recurrence maintain us in caring and, thus, contribute to the enhancement of the ethical ideal" (Noddings, 1984, p. 147). That is, intellectual work can help people to care (for others, for plants, for animals, for other ideas) and can lead to an expanded notion of the ethical self.

In preparing and enacting her lessons Karen tries to create situations where her students can encounter mathematics. This is not to say that there are not times where there is direct instruction, as when Karen informs her students of the arbitrary conventions involving the labelling of angles. But the true heart of mathematics that she works for them to encounter lies in the moments where students discuss, make mistakes, conjecture, revise their thinking, and are deeply engaged with mathematics. Alongside and all around this care for mathematics that Karen engenders in her students is their care for one another. Aidan and Thomas, though not particularly good friends, encounter one another through the mathematics they explore together. Both forms of care involve emotional, intellectual, and moral work; they are taut with tensions, congruities, and complexities. Care for people and care for mathematical ideas can nourish one other.

In this chapter, I have looked closely at three mathematical sites of care: indifference, mistakes, and conjecturing. Drawing on field texts and academic texts, I have considered care in both the immediate milieu of Karen's classroom as well as in wider contexts such as mathematics and mathematics education. Two forms of care, caring for people and caring for mathematical ideas, have given shape to Chapters 4 and 5. Both forms of care involve emotional, intellectual, and moral work; they are not easy and are taut with tensions, congruities, and complexities. In the next chapter, I explore the work involved in care as well as possibilities for the two forms of care that I have described.

CHAPTER 6: MAYBE

A few nights before I began to write this chapter, I heard the last few minutes of *Ideas*, a program on CBC Radio ("The ideas of Jerome Kagan," 2008). The person speaking was Jerome Kagan, a developmental psychologist and philosopher of science. I thought I knew what he would say, something about normalcy and certainty. But he surprised me. He talked about how in science, just as with children, we cannot know anything for sure. Although he described probabilities, he emphasized that a person's life is influenced but not completely determined by his or her childhood. I found his words to be hopeful and full of possibility.

Kagan recounted a fable about a king who sent his scholars to distil the knowledge of the world into one word. The scholars protested, saying that it was an impossible task. The king countered by saying that this was why he was asking them to do it. Years later the scholars returned to the king with a piece of paper. On the paper was written one word: *maybe*. I think of the possibility and hope in that one word. Maybe. It speaks volumes about how I think about knowledge: it is created within each person but connected to others; it is improvised but based on experience; it evolves and is culturally-bound, at times a sufficient guess at what is going on in the world.

The last chapter of a dissertation is traditionally about the knowledge (or knowing) generated from the study. It is the *maybe* kind of knowing that I would like to share in these pages. My maybes around care emerge not from a cautious, superficial place, but from the meaningful, deep experience of having walked alongside Karen and her Grade 6 students. My maybes spring from my personal and academic lives and are connected to my family, friends, colleagues, and students, as well as to Karen and her Grade 6 students. My maybes are improvised but nonetheless firmly based on my four months of research in that classroom and on the work of others, just as Karen's improvisations in her teaching are based on her students and on her "personal practical knowledge" (Clandinin & Connelly, 1996, p. 25). My maybes are maybes because I know care is different in different contexts and cultures and that it changes over time. I offer my maybes about how a teacher cares both for her students and for mathematical ideas in an elementary classroom as a contribution to a larger ongoing conversation about care.

As a way of returning to the beginning of this dissertation and to my roots of care, I begin with some personal reflections about caring both for people and for ideas. I also carry on the story of Karen and her students, pulling forward the threads of their care for one another and for mathematics. I introduce a new *maybe* into the conversation, the idea of a counterstory of care and mathematics in the classroom. These sections are connected; individual, relational, and social aspects of care are intimately linked.

Reflections, Images, and Metaphors: Personal Maybes

There is a kinship between the reciprocity involved in caring for people and the reciprocity in caring for ideas. I feel this pointedly as I become a mother. As I write this dissertation, I am also authoring a new life in my pregnancy. As I reflect on the fact that every person has come into this world by being nurtured and carried inside the body of a woman, I am reminded that the ideas that come into this world are also deeply connected to the people who nurture and carry those ideas forward. I feel the reciprocity in my pregnancy that comes from caring for the being inside of me, despite the frustrations of nausea and fear. From my growing baby, I receive confidence in the strength and health of my own body, a sense of amazement that I am growing a person in my belly, and joy at bringing forth new life into a loving relationship. There are parallels for me in caring for mathematical ideas, despite the frustrations involved. I receive confidence in the strength and health of my mind, a sense of amazement at the abilities that we share as people, and joy at bringing forth my own (and others') mathematical knowing.

Connections between care and parenting have been both robust and surprising throughout this study. Though I recognize the roots of my interest in care in my own family experiences, the parallels between Karen's care for her own children, especially Anna, and for her students were unexpected. Karen referred to her experiences of parenting Anna as she worked to care for her student Mariah. Both young women had learning difficulties and, for fear of being judged negatively, struggled with sharing the challenges they faced with those around them.

Karen shared some of her daughter's stories in class and some in our conversations. One story included an artefact: a wall hanging. The small quilt includes words that Anna wrote in e-mail messages as she travelled overseas. Karen cherishes those messages not only for the connection to her daughter but also because she knows how much time and work Anna put into producing them. This appreciation for intellectual work as part of care extends to the classroom as Karen recognizes her students' academic efforts. She watches Mariah with caring eyes as Mariah tries to maintain a cover story of herself as a student working on the same mathematical ideas as her classmates. Karen knows that her daughter used similar strategies in school. Karen responds to Mariah by privately acknowledging both her effort and her difficulties. While I was in Karen's classroom, Karen drew on her parenting experiences. Sometimes she stated this plainly to the whole class; at other times she reflected on the experiences in conversations with me about the classroom. I did not see the connections to care during my research days. It was a path that I only saw in looking back at where I had walked with Karen and her students. These parenting parallels have become even more relevant to me during my pregnancy.

Remembering the caveats of other researchers (see the section *Critiques of Care* in Chapter 2), I offer these connections between care and parenting, especially mothering, not as a singular way to conceptualize care, but as a way to acknowledge the importance of caring parental relationships to me, to Karen, and to many others. In my own life, I can also point to a particular artefact as a symbol for the significance of mothering. As a gift when I completed my Bachelor of Education and started my teaching career, my mother cross-stitched a *Mothers' Tree*. It is a list of my female ancestors, beginning with the first to come to Canada from Ireland, Alice Fenton McNeill (b. 1821), and ending with me. This tracing back of mothers is an unusual way, at least in North America, for a family tree to be organized. For each woman on the list, my mother's family has a story or stories that have been shared over and over. I identify strongly with their stories of care, perseverance, hard work, kindness, and humour. The last three women on the list, my grandmother, my mother, and me, have all been teachers. Our identities as teachers are intertwined with our identities as women and as mothers. Karen's experiences are similar.

I recognize that other people's experiences of parenting (as a child or as a parent) are different from my own and might not serve as appropriate inspiration for caring for other people or for ideas. Here, I can offer other images of care. I think of friendships I have formed in my doctoral journey. Care is an integral part of my relationship with my special friends Jody and Shelley. We enjoy profound attention as we take our turns in regular cross-country conference calls. We respond to one another's stories, accomplishments, disappointments, and daily lives with support and humour. We derive pleasure and a sense of belonging from the reciprocity of our relationships. We also care for ideas as we write, both separately and together. Our friendship began with a presentation we made at an academic conference and our subsequent conversations have been flavoured by the ideas that interest us collectively and individually.

In thinking about parenting, friendship, and other images of care, I am reminded of a metaphor I offer in Chapter 2: teacher as both curate and curator. That is, a teacher cares both for people (as a curate of a religious congregation might care for parishioners and people in general) and for things (as a curator of a museum might care for objects or ideas). In the context of mathematics, Karen is both curate and curator. For example, in the *day in the life* given in Chapter 4, Karen listens to the mathematical thinking of several students as they explain their solutions to the grass-seeding problem. Khalil's answer is different, as it incorporates an assumption that the store sells half bags. Karen values Khalil's experiences of stores and his mathematical knowing. In an example from Chapter 5, Karen responds to Emily's questions about straight angles. Karen listens intently and takes Emily's query seriously, pausing to think about the acute angle symbol that is used to label all angles. The profound attention that Karen shows to both students and to their mathematical ideas is a sign of her care. Karen cares both for the students as people and for their mathematical ideas.

Karen's work with her students as well as my familial and friendship relations reflect this curate/curator duality as people attend to one another and to the ideas that are important to those they care for. Curates and curators also rely on powerful stories in their work: stories of spiritual inspiration and stories of what is important to a culture. Karen's daughter Anna's life and school experiences serve as inspiration for Karen as she works with her students, just as a curate is inspired by others' experiences. Cultural knowledge of mathematics, which Karen developed during her studies and her teaching, is also an important source for her work of caring for students and their ideas, much as a curator draws on cultural stories in developing an exhibition or collection. In this way, Karen is both curate and curator in her mathematics classroom.

The metaphor of teacher as curate and curator comes from an exploration of the etymological roots of care. Two other metaphors emerge from this study: one from Karen's classroom and one from my personal reflections. One metaphor is that of the caring teacher as both composer and improviser. Karen thought a lot about what tasks would invite her students to engage with ideas. She considered the prescribed curriculum, the materials available, and her students (personalities, ethos of the classroom, events of current interest, understandings they demonstrated in class). She scheduled each day's events, posting the plan on the board. She thought about good questions to ask and about how students might work with one another and with the materials. Karen gathered photocopies and overheads. She prepared the computer, blackboard, or other space for the lesson. Karen composed the school day as she made mental and physical notes, thought about underlying structures, and considered the instruments as well as the musicians. These general examples are drawn from Karen's practice, but a few examples are of particular importance to mathematics.

Karen's preparation was thorough and thoughtful. At the same time, she improvised regularly; the composition was not inflexible. In the example in Chapter 5, Karen asks students to look at their math homework and to think about their mistakes. This was not part of Karen's original composition. During her regular homework check, Karen notices some errors in student work. Without pointing out the errors (and the people making the errors), Karen revises her morning plan on the spot so that all students have the opportunity to examine their mathematical mistakes and to work on them. In this way, Karen shows her care for her students (by not singling them out for their mistakes) and for mathematics (by providing a supported opportunity to work on errors). The math homework was a part of the regular plan and Karen has thought carefully about what tasks to include. But Karen improvises on the composition as she attends to what students have done mathematically and to the ethos of the classroom. She responds spiritedly to students' work, helping them to engage with ideas. She supports their learning and their growth as human beings. But the improvisations are based on Karen's deep understanding of the subject matter, especially mathematics, as well as on her developing relationships with her students. Through both composing and improvising, Karen cares for her students and for mathematical ideas.

The last metaphor is of the teacher as both parent and midwife. When she works with her students, Karen draws deeply from her practical knowledge as a mother and an experienced teacher. She told me stories of her children's growing up. Sometimes she used the same words to describe her students and her children. Her choice to teach half-time is shaped by her commitment to her family. My family also shaped my teaching. My experiences of my parents' care for children in their work as a teacher and a social worker were embodied in my own classroom. I anticipate that the experience of becoming a mother will also colour my care. The teacher as parent is one who cares deeply for the individual child.

The teacher is also a midwife. In the classroom, a teacher works supportively with students for a certain period of time, just as a midwife might assist a woman through pregnancy and birth. A midwife takes part when a woman brings forth a child into the world, just as a teacher participates when students bring forth ideas into the world of mathematics. Midwives and teachers draw on their formal training and their practical experiences. When Karen listens openly, crafts tasks, responds dynamically, and maintains attentive proximity, she accompanies students in their learning. These characteristics are also valued in a midwife[36].

In Plato's *Theaetetus*, Socrates, the son of a midwife, calls himself a midwife of ideas (Sedley, 2004). His midwifery involves questioning and working with the experiences his students have already had; there is a sense of bringing into awareness the knowledge that is hidden in the student. This is not quite what I mean by teacher as midwife, especially in mathematics.

In the context of mathematics, Karen's midwifery is different from that of Socrates. For example, through questioning, Socrates leads a boy to the Pythagorean Theorem mathematical generalization that a new square with twice the area of an initial square would have side lengths equal to the diagonal of the initial square (Fauvel & Gray, 1987, p. 61-67). Though it sometimes involves questioning, Karen's practice also includes setting mathematical tasks for her students to work on as they birth their own ideas. In the example in Chapter 5, Aidan and Thomas work on the probabilities involved in a game. They make conjectures about which combinations would lose (odd numbers times odd numbers) and whether the game is fair. Another important aspect of Karen's mathematical teaching is listening, a part of the profound attention involved in care. She is available to Aidan as he begins conjecturing. She does not ask questions at this point. She simply listens and, through that listening, affirms Aidan's line of thinking. He continues to explore the multiplication of odd numbers and gets very close to a generalization about multiplying odd (and even) numbers. Aidan gives birth to this generalization. Karen is nearby as the midwife, providing an appropriate task, listening, not asking questions (at that point), and shaping the conjecturing atmosphere in the classroom.

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[36] Nathalie Sinclair (2007) explores obstetrics practices such as the introduction of the Apgar score, the use of forceps, and the performance of C-sections and how these could inform teaching and research practices in mathematics education.

These metaphors, my personal maybes, offer ways to think about the complexity and difficulty of care through familiar images in an unexpected context: the classroom. The duality in the metaphors (curate/curator, composer/improviser, parent/midwife) shows that roles that may seem to be at odds are an appropriate way to describe the work of care in the classroom. To care as a teacher is complex and difficult: it involves emotional, intellectual, and moral work.

Emotional Work

I use the term *work* to signify activity and action, not drudgery, though care may have negative functions. Lynn Isenbarger and Michalinos Zembylas (2006) write that "Emotional work involves many emotional costs, and is often invisible, unacknowledged, or devalued; consequently, conceptualizing this as a form of work challenges assumptions of care as natural or effortless" (p. 123). One of those emotional costs is frustration. Karen expressed frustration around caring both for her students and for mathematics. Depending on the situation, she sometimes told students about her frustration, while at other times she discussed the frustration in conversations with me.

In one classroom moment, Karen told students that she was feeling frustrated about getting their attention after a task about surface area and volume. The task had taken longer than she expected. She wanted to draw their attention to some mathematical ideas, but students were not listening. The reciprocity that usually flavoured teacher-student interactions was incomplete as students chatted and fiddled with the objects they had used for their tasks. Karen was working at caring both for the students and for mathematics, but she felt some frustration when her care was not returned immediately. As Karen continued beyond the frustration, most students were able to engage in another meaningful mathematical task.

Frustration is especially important in mathematics. As a student of mathematics, I can think of many, many instances of feeling frustrated at not being able to solve a problem or complete a task. For most of those instances, I can also remember feeling a mixture of pleasure, pride, and triumph at coming to a solution, to a partial resolution, or to completion of the task, having persevered through the frustration. In another classroom moment, Anne and Samantha worked on a computer version of Nim[37]. They expressed frustration at not being able to win and not having strategies for winning. When Anne finally beat the computer, she and Samantha celebrated and began strategizing about how to win again. Karen later introduced a way to play the game without the computer. Again, students began making strategies. They also began to recognize when they had lost or won, even before the last move had been played. Still, no one, including Karen and myself, knew exactly how the game worked. Though there was a sense of frustration at not being able to explain the game or to win every time, there was also a sense of delight as we tried to figure it out together (and as students were able to beat the teachers).

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[37] Nim is a game of strategy where two players take turns removing objects from different piles. See http://en.wikipedia.org/wiki/Nim for more information on variations of the game as well as winning strategies.

Students continued to play Nim for days. Karen did some research on the game and found out how to win. She continued to support students' mathematical thinking as they began to work through the many possibilities for moves. She did not take away their frustration by telling them how to win. Nor did she increase their frustration by playing against them and winning. She monitored the emotional costs of her students' care for mathematics and balanced them with the gains. One of those gains was students' engagement with the game; many played during lunchtime, after school, and at home. And there were other gains, such as Anne's pride in being able to win consistently (students sought her as a partner so they could try to figure out her strategy). Anne began to see herself as mathematically capable even though she continued to struggle with basic facts in multiplication and division. Within the frustration that is part of doing mathematics, there was space for Karen to care *both* for her students and for mathematics. She paid profound attention to her students and she also attended profoundly to mathematics through her students without removing the frustration that is inherent in the doing of mathematics. This caring for both is not always easy; it demands that Karen pay attention and carefully monitor students' levels of frustration. Hard work and some emotional costs are involved as Karen cares and as her students care.

In a sort of academic Mothers' Tree, I am inspired and informed by the work of researchers who have come before me. The branch of the tree that has to do with mathematics education and care contains a very short list of names and dates of ancestry. Amy Hackenberg (2005b), who describes the cognitive and emotional work involved in her caring teaching practice with sixth-graders, is one of the few. She writes in detail about the mathematical tasks she poses and modifies as well as about her attention to the affective responses of her students.

Hackenberg's work focuses on attending to feelings of stimulation and depletion as part of an ethic of care. This is similar to the ways that Karen monitors levels of frustration in herself and her students. However, Hackenberg does not examine how these feelings might be related to the nature of mathematics. For example, part of what it means for Karen and her students to do mathematics is to receive something in return from the subject matter, as in the example in Chapter 4 when Khalil uses what he knows about the relationships between one thousand and five hundred to help him figure out how to convert 1500 metres to kilometres[38]. Part of the nature of mathematics is that ideas are connected. Khalil makes connections among number, measurement, and decimal representation, connections that stimulate a new understanding of the work he is engaged in. Previously, he relied on algorithms to solve similar problems. Karen finds great pleasure (or stimulation) in Khalil's sense making.

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[38] In Caleb Gattegno's terms (1980), this is an example of "if you know a little you know a lot" (p. 15).

In another example, Emily feels confused (or depleted) about why an obtuse angle would be labelled with an acute angle symbol. Here, the arbitrary aspects of mathematics block further intellectual work. Karen eases Emily's frustration by responding to Emily and to her question. This is not a site for Karen to care by supporting Emily through her frustration as she does with Anne and Samantha when they work on Nim. Emily cannot figure this out for herself because the angle symbol is a convention of the mathematical community that must be told. In the moment, Karen is momentarily puzzled by what Emily is getting at and by what to do next. Feelings of frustration, confusion, or puzzlement may lead to depletion. The emotional work involved in continuing to care through these feelings is linked to the nature of mathematics.

Intellectual Work

Hackenberg (2005a) also writes about the intellectual work involved in care: "mathematical carers hold together their work toward mathematical learning and their work toward balancing stimulation and depletion in mathematical interactions with their students" (p. 47). Intellectual work is involved in understanding what students are communicating about mathematics as well as in planning what to do next. In the example in Chapter 5, Anne and Khalil present their work on calculation errors from their math homework. Karen listens carefully to what each has to say. Hackenberg might call this form of listening and the subsequent understanding that Karen forms of Anne and Khalil's mathematical thinking "second-order models" (2005a, p. 49). That is, a teacher's focus is "not to confirm their own mathematical thinking but to make images of and conjectures about *students' mathematics*" (2005a, p. 49, italics in original).

This intellectual work is not directly visible. I was able to see Karen's body language as she listened and responded to Anne and to Khalil. She faced them, looked at them, and set aside other things that needed to be done that morning. I also observed some of Karen's actions: she asked questions about what they were thinking and commented on how their errors could be used by other students with respect to basic facts. But I did not see the work that was going on inside Karen as she attended to students' reactions, words, and writing. Nor did I observe Karen making these second-order models of what Anne and Khalil might have been thinking. Intellectual work is subtle and veiled in the classroom.

In our conversations and in fleeting comments in the classroom, Karen talked with me about how she thought about her students' mathematical thinking. For example, during "All-day Math," one of the tasks was to use information from the newspaper to compose and then solve a mathematical problem. Karen talked about Khalil's work: "One of his questions was . . . [to] add up all the numbers . .

. he was seeing the numbers as very discrete and separate from the meaning of what there was on the paper . . . [a] math problem for him was, take the numbers and then do some kind of a calculation thing with them." Karen made conjectures about how Khalil was thinking about the addition he had proposed as a mathematical problem. She had formed an image of how Khalil understood the doing of mathematics. Later in the school year, Khalil began to make connections among mathematical ideas. Karen conjectured that Khalil had moved away from an image of mathematics as calculation. I describe this event in Chapter 4.

Between the time Khalil proposed a mathematical problem as an addition devoid of context and the time he explained a metric conversion by drawing on his knowledge of number, Karen and Khalil both carried out intellectual work as they cared for mathematics. The work was incremental; I cannot point to one moment or even a series of moments that brought forth new understandings for Karen and Khalil. The work was intellectual in the sense of focusing on caring for ideas, but it was also bound up with their relationship with one another. Karen and Khalil received something from this intellectual work. For Karen, it was the pride and pleasure at seeing Khalil enlarge his mathematical knowing. For Khalil, it was the mathematical connections that he was able to use in new situations.

Hackenberg (2005b) is able to describe her own intellectual work with students, but it is important to point out that this work is not always observable in the classroom. Hackenberg has a privileged position as both the teacher and researcher: she has access to her own intentions. Similarly, Rena Upitis, Eileen Phillips, and Bill Higginson (1997) engaged in working on a variety of mathematical projects with students in Grades 3 and 4. They, too, were able to describe their intentions to one another and often had to clarify these intentions while the students were present. The intellectual work involved in the day-to-day planning as well as in their responses to students, to one another, and to the mathematics was obvious. However, in a classroom such as Karen's, though a teacher might sometimes ask for confirmation about what he or she thinks a student is thinking mathematically, it would be difficult and counter-productive for the teacher to say explicitly what question he or she will ask next and to justify that pedagogical decision in the context of mathematics. Karen's intellectual work was undeniably present but hidden until I engaged her in conversation around what she was thinking, doing, feeling, and aiming for.

Lisa Goldstein is also part of my academic mother's tree. Her research does not grow on the mathematics education branch of the tree, but focuses on the work of care. My study extends the notion of caring work to a specific classroom context and site for care: mathematics. Goldstein (1998) writes that "caring encounters are, by their very nature, variable, situated, and unique" (p. 246). By looking at Karen's care both for her students and for mathematics, I expand situations (or sites) of care and variations on caring beyond Goldstein's descriptions from the early childhood context. Exploring what is special about care in mathematics is a relatively new field of research; it offers possibilities for considering relationships amongst teachers, students, and subject matter.

I situate my work within this new field, at an intersection between mathematics education and care theory, but firmly based on classroom experiences. I do not seek to carve out a model of care that is unique to mathematics. Rather, I am interested in the interactions between care for students and care for mathematical ideas as well as how those interactions are lived in an elementary classroom as emotional, intellectual, and moral work.

Goldstein also writes about caring as an intellectual activity. She describes it as "a legitimate foundation on which to base an early childhood curriculum" (p. 259). As I reflect on the moments and sites of care I have offered from Karen's classroom, I claim that care is also a legitimate way to consider teaching and learning mathematics, though there may be emotional costs and intellectual challenges to this approach.

Moral Work

It is the moral dimension of Karen's caring work that I find the most difficult to describe. Her work has a sense of "balancing the tension between teacher goals and student desires" (Goldstein, 1998, p. 255). In the example in Chapter 5 where Aidan shares his thinking about the probability game, Karen pointedly asks Thomas and Josh to listen instead of chatting. She shapes a moral space of caring both for Aidan and for his mathematical ideas. Moral work takes place as Karen looks for a new, caring way to communicate to Thomas and Josh that their aims have to be set aside in that moment (she has already reminded Josh to listen). She invokes their teacher-student relationship and makes her needs clear: "I need you to turn around because Josh needs to listen and he won't if you are talking to him. I need you [Josh] to listen too." She points out that Aidan's conjectures could be helpful to Josh in his basic facts. Karen communicates her needs as a teacher and recognizes an opportunity to help Josh engage in mathematical thinking (she is sensitive to his needs as a student).

Like Karen's emotional and intellectual work, her moral work was subtle. In mathematical contexts, moral work was more obvious. For example, as Karen and her students studied probability, they played several games. A student mentioned that one game was like gambling. Karen took the comment seriously and told the class about the difference between gambling and playing a probability game ("gambling is when something you care about is on the line"). She also talked about the negative effects of gambling by sharing a story of a family she knew. This classroom moment was fertile ground for a moral discussion within the context of mathematics. Karen's comment about care is important; it points back to the indifference in mathematics that can be viewed as safe or constructive. In a probability game, there is nothing "on the line" to care about, like a paycheque or a house in a gambling game. That is not to say that mathematics is amoral, but only that the indifference that is part of the nature of mathematics, as I discuss in Chapter 5, can be useful and can provide a safe context for moral work.

On another occasion, Karen found that some practice test questions about statistics were "not good." This led to a discussion about *goodness* in the context of a mathematics test, about what makes a good sample, a good question, a good estimate, a good argument, a good strategy, etc. Moral work involves finding *good* ways of negotiating a situation. The mathematical community has established some of those ways (though they are not inherently good or bad) and Karen points them out, such as the symbol that is indifferent to the type of angle in the example in Chapter 4. But in school mathematics, there can be many good ways to solve problems or to engage in tasks, as Karen acknowledged when she regularly asked students if they had done their work in a different way.

All three forms of work I have distinguished here, emotional, intellectual, and moral, comprise part of Karen's care both for her students and for mathematics. This work is subtle and difficult to communicate. Caring work has long been regarded as natural for women (Rodríguez et al., 2006). It is perhaps for these reasons that many people underestimate the work of care. The power of care, viewed uniquely as an innately feminine trait, dissolves under a tide of sexism and biological determinism while the work of carers, both men and women, is marginalized. Though Noddings describes *natural* care as the root of all care (that is, by virtue of our humanity, we share an impulse to care for others) she also acknowledges that such care can be nurtured and that it lives within *all* people, not only in women. Care extends far beyond a personal quality to be respected and serves as a way to reconceptualize teaching, learning, and living while honouring experience and work.

Goldstein (1998) claims that an ethic of care "provides a way of thinking about caring that repositions the concept, transforming it from personality trait to a deliberate and decisive act" (p. 247). I see an ethic of care as including emotional, intellectual, and moral work. By describing experiences from my life and from Karen's classroom, I draw attention to the work of care in classrooms and to the complexity of caring both for people and for ideas. The emotional, moral, and intellectual work of care has been taken for granted, especially in elementary schools. Naming this care as valuable, difficult, joyous, challenging, and complex work recognizes the professional responsibilities of teachers as well as the depth of the personal practical knowledge they bring to bear on those responsibilities.

Karen, Her Students, and Mathematics: Relational Maybes

After the school year in which I conducted my research finished, I continued to stay in contact with Karen, and through her, with her students. Every time I visited her, we talked about our lives and she gave me updates on her former students. Several of them still stop by and visit her. I find this intriguing; I cannot imagine myself as a seventh grader in junior high dropping in at my elementary school. But Sophie, Alex, Khalil, Josh, and Damian visit regularly, bringing their news and stories of their classmates.

It is Sophie's stories that I find particularly compelling. Sophie, with her strong interest in sports and her willingness to persevere with her mathematical work, regularly used to invite me into conversation and sought out my help when I was in her class. In the fall, after Sophie had started at her new school, one of her visits coincided with one of mine. She opened her arms for a hug and I remarked at how tall she was getting. We chatted for a bit and, before leaving, Sophie and her friend talked about being bullied and becoming bullies at school. They treated it lightly and used street talk, appearing tough and aggressive, but there seemed to be more to it. At our next meeting, Karen told me that Sophie had begun to see her interest in sports as an advantage. She said Sophie had found that joining various teams was a great way to get to know the boys she was interested in. A few months later, Karen shared that Sophie, who did not seem to be doing well academically, was also developing an attitude that academics do not matter to her. Karen said that when she had a chance to talk to Sophie one-on-one, Sophie told about how her sister gets Sophie to cover for her when she skips school.

The lives of Karen, Sophie, and the other students are still unfolding. They go through difficult times, such as Sophie's experiences of bullying and her continual negotiation of the social pressures of her new school and her family. Karen also has challenges as she works with a new group of students in Grade 6 and pursues her interests outside of school. And still, there are spaces for Karen and her former students to encounter one another and to carry on caring. The after-school classroom maintains the familiarity of the routines and the aura of certain ghosts, while Karen's welcome and the presence of former students continue to affirm the reciprocity of their care.

Karen's daily classroom work of caring both for her students and for mathematics has brought forth continued response from her former students as they visit her and share confidences. But there are some important differences in their current relationships: they are voluntary (the former students no longer *have* to come to Karen's classroom) and they no longer involve ideas in a formal curricular sense. Care for people is at the heart of an ethic of care. As people change, so does the flavour of their care for one another, even if that means that the spice of caring for mathematics that was evident in their profound attention for the subject matter is but a memorable seasoning for some of Karen's former students.

The time that Karen and her students spent together in Grade 6 provided, at least for some, a sense of belonging and of grounding that they continue to draw on. This belonging reminds me of a passage from Jean Vanier's *Massey Lectures* (1998):

> A little child is only heart; he thrives off relationships; his joy is in relationships; he grows through relationships. When he is in communion with someone he trusts, he is safe, he is someone, someone unique and

> important. He is thus empowered, for the rest of his life, to be open to others, and to bring this sense of empowerment into his work. (p. 85)

Though Sophie is no longer a little child, she trusts Karen and feels safe enough to share her disappointments and joys. And when I saw her in the after-school classroom, I had the impression that she drew on her connections to Karen, to me, and to her friend in order to begin to talk about bullying at school. Though the care that we shared on that day no longer involved formal curriculum, we had forged our relationships in the context of caring for mathematics and other subject matter.

The caring I describe is in some senses different from the care that Noddings (1992) describes in *The Challenge to Care in Schools*. In that book, she imagines schools organized around centres of care (self, others, animals, plants, the environment, objects, and ideas) and the passionate interests of students. Though I have no doubt that Karen's aims are aligned with Noddings's suggestions, Karen must also attend to the prescribed curriculum. Noddings also proposes that the "primary aim of every teacher must be to promote the growth of students as competent, caring, loving, and lovable people" (1992, p. 154) In the very real context of Karen's classroom meaningful interconnections between caring for people and caring for ideas come alive. One way that Karen works toward the growth of her students is *through* the subject matter. Caring for ideas is part of her caring for students. Instead of only teaching mathematics to those who have an avid interest in it, as Noddings suggests, Karen works both with the prescribed curriculum and through mathematics to care for all her students.

The two forms of care on which I focus in this study, caring for people and caring for ideas, can sustain one another. My interactions with Sophie were primarily in the course of doing mathematics, though our initial conversations were around other topics of interest to her, such as soccer. As we began to know and trust one another, Sophie felt open to working on mathematics with me. Sometimes she would ask me simply to check her work, while other times she asked for help in understanding an idea. Caring for one another as people helped us to care for mathematical ideas with one another. And our caring for mathematics enabled us to know one another and to care for one another more deeply.

For example, one day just before the bell rang, Karen told students that she would be around after school if they wanted to finish working on math. Most students filed out but Renee and Sophie stayed behind. Knowing that it was Karen's planning day, I stayed to help Sophie as Karen sat with Renee. We worked on angles, especially with identifying different angles in the stylized stained glass art on a worksheet. Before leaving, Sophie talked to Karen and me about her family. Though this conversation was short and ordinary, it might not have taken place had we not first worked on mathematics. The context of mathematics provided a safe place for Sophie and me to care for ideas alongside one another; the mathematics would not judge us. It was as if our work with mathematics served as an exploration and a test of our profound attention and openness to response before our care could be expanded to the personal realm. Sophie reciprocated our care for her by sharing stories of her family life[39].

There are other examples of how caring for people and caring for ideas sustain one another. I think of how Karen calls on her caring relationship with her daughter, Anna, in order to care for Mariah and to support Mariah's care for ideas in various disciplines, especially by letting her use a calculator in mathematics so she could focus on the same ideas as her classmates and worry less about basic facts. The three mathematical sites of care I discuss in Chapter 5 are further examples. The existing relationship between Karen and Emily allows them both to engage with mathematics in the context of angles. The atmosphere of Karen's classroom encourages Anne and Khalil to work caringly with their partners as well as to care for the mathematics by exploring their mistakes and sharing their ideas. Finally, Aidan and Thomas get to know one another better and are able to care for one another through their conjecturing about probability. Their mathematical conjecturing provides a space for relational conjecturing as they try out new ways of communicating with one another.

On the basis of these and other examples from the classroom, I claim that caring for people and caring for ideas are not separate forms of care, but that they are linked in complex and sometimes supporting ways. Though Noddings (1984) writes that the intellectual experience in caring for ideas belongs solely to the individual, I think that although the response a person feels when he or she work on mathematics is individual, it can still connect the person relationally to others. This is a departure from Noddings's claims. While Noddings (1992) argues that the traditional subject areas are inadequate for educating and caring for the whole of a person, I see in Karen's practice that working on mathematics can support caring for people and caring for ideas. Weyl-Kailey (1985) described her own work with students as supporting both their mathematical ideas and their personal growth. Similarly, Karen uses the context of mathematics to care for her students. Though the arbitrary aspects of mathematics may block or complicate care, there are many more examples where one form of care confirms the other. I again point to how Karen sustained caring for her students through their learning responses in mathematics and through visits from her former students. My rapport with Sophie was grounded in caring for mathematics before it opened to include our family lives. Through their conjecturing about the probability game, Aidan and Thomas engaged in a caring relationship that was deeper than sitting next to one another at the computers. In this and many other ways, experiences of caring for people and caring for ideas can sustain and enrich one another.

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[39] There are echoes here of Weyl-Kailey's therapeutic work with students on mathematics, which I describe in Chapter 5.

Dominant Stories in Education: Counterstory Maybes

In the background of the selected stories that I have shared from Karen's classroom, other broad stories were being told and lived. Grade 6 is a year for Provincial Achievement Tests (Alberta "Parent guide to provincial achievement testing: Grade 6," 2006) in language arts, mathematics, science, and social studies. Karen's students wrote the tests in May and June, while I was in their classroom. Though the students did not seem overly stressed by the tests, the Provincial Achievement Tests played a role in Karen's planning for mathematics and science lessons (language arts and social studies were taught by her teaching partner).

Since the tests in mathematics and science are multiple choice, Karen provided opportunities for students to work on these types of questions (alone and in groups). They discussed strategies for choosing answers and for test-taking. Karen did not emphasize high test scores; rather, she asked the students to put forth their best efforts. Still, her students have consistently achieved good standing on this test over her many years of teaching.

Karen talked to me about feeling pressure to change her teaching practices to spend more time on practicing traditional algorithms and to put increased emphasis on procedures (as opposed to *making sense*) because operations are an important component of the achievement test. In one of our conversations, she described this pressure as a temptation to teach the necessary in mathematics as arbitrary[40].

The assessment/achievement story is a dominant story in education. We measure student success through standardized tests locally, provincially, nationally, and internationally. Much importance is placed on grades and high test scores, especially in secondary school. In high-stakes testing, it is easy to think of teaching and learning simply as ways to prepare for the test. There are good reasons for using standardized tests, but to use them as the sole measure of student (or teacher) growth is an overly narrow way to view both human beings and education. In elementary schools, the stakes are not yet high, though they are beginning to rise as schools in Karen's district advertise their scores on large signs and parents consider the relative quality of schools based on these test scores.

Karen and many other teachers have resisted this dominant story of achievement, while still valuing intellectual engagement and activity. In the midst of the testing, Karen told me about the thinking one student shared with her. The student had been working on a multiple-choice question and had noticed a pattern in the given table. When she extended the pattern, she made a calculation mistake and could not find the answer among the choices. Convinced that there was an error on the test, she approached Karen, who could only listen attentively to what she called

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[40] We discussed Hewitt's ideas of arbitrary and necessary in a taped conversation. See Chapter 5.

"terrific work." In that moment, Karen showed her care for the student through careful listening and valuing the student's thinking. In a sense, she also showed that she did not care for the test: she did not emphasize that there was a correct answer, nor did she direct her student to look over her work or to read the question again. With me, Karen shared her temporary frustration at the constraints of the test. Karen resisted a dominant story of achievement by attending profoundly to her student even though she felt she "should just sit in [her] desk" and let the test show the student's capabilities.

In this testing situation and in many moments of teaching, Karen focused on making sense, as I describe in Chapter 4. The experience of accompanying her daughter Anna through the challenges of learning, especially mathematics learning focused solely on procedures, profoundly shaped Karen's teaching practices and confirmed her commitment to making sense. But Karen told me of another shaping influence on her teaching: her participation in a professional development community. In this dissertation, my focus has been on Karen's classroom, but the effects of this professional development experience on Karen's teaching practice came up again and again in our weekly conversations. For this reason, it is worth exploring this experience, though this is the final chapter and "new" data are not usually presented in this context.

A mathematics professional development program was initiated by Alberta Education and carried out in Karen's school district. Some funds were directed to the schools to use as they saw fit within the mathematics focus. The rest of the money was used to support monthly in-service sessions and to pay the mathematics consultants who coordinated the program. Consultants came to the classrooms of participant teachers "if we wanted to be coached or wanted to [have] a demonstration." Karen was impressed that the program was designed for, and lasted, three years and that most of the participants stuck with the program.

Karen said that teachers were committed to the program partly because the consultant in charge, "was knowledgeable and enthusiastic." The consultants coordinated visits, coaching, and teacher demonstrations in their classrooms, but also chose and shared professional readings and made student work from the teachers' classrooms a central part of the in-service work. Through their attention to student thinking (in the particular contexts of the teachers' classrooms as well as in their general understanding of the ways people do mathematics), the lead consultant and her team consistently showed care for the teachers, the individual students of the teachers, and the ideas of mathematics. Karen added that the consultants "didn't push" teachers to do things that they were not comfortable with, which reminds me of Karen's practice of encouraging students to try something new (such as presenting) without being coercive. Karen observed, "it changed me as a math teacher for sure and I went into that thinking I already know how to teach math."

Karen's commitment to care was confirmed. She found a community in which to resist the dominant story of achievement in education. Hilde Lindemann Nelson (1995) writes about chosen communities, such as the professional development community Karen opted to participate in. These chosen communities are places where the members can examine their own identities as professionals and as humans within the particular contexts of their profession and society. Nelson goes on to write about how these chosen communities can create counterstories, or "narratives of resistance" (1995, p. 24), that help the members to question and explore the dominant stories that gloss over difference and particulars. Though counterstories were not part of the official professional development agenda, Karen often referred to her experiences within that community as a way of affirming her classroom work.

Karen's way of caring both for her students and for mathematics is for me a counterstory to the dominant stories of achievement in education and of care as a "soft," innately feminine attribute. Karen puts emotional, moral, and intellectual work into her teaching practices, finding ways for students to engage in mathematics that enrich their relationships with one another and with the subject matter. She develops her care through reflection on her lived experience, with the support of various communities (including the professional development community), and through her relational work with students.

Other dominant stories are challenged through Karen's counterstory. First, I think of the stories in education about elementary teachers who are uncomfortable with mathematics (Gellert, 2000) or who have a fragmented knowledge of mathematics (Ma, 1999). Karen's love of mathematics is deepened by her teaching practice. Her colleagues visit on a regular basis to observe or to discuss ideas for their mathematics classrooms. Her students' questions and interests spur her own learning. Instead of seeing the prescribed curriculum as fragmented, Karen sees connectedness in mathematics and emphasizes the connectedness through making sense. She also seeks connectedness with and among her students as they work on mathematics.

Second, I consider the stories of mathematics as a gatekeeper, as abstraction without emotion, and as a collection of procedures for finding right answers. The mathematics Karen and her students encountered was much more complex, interesting, and engaging than these narrow definitions suggest. Mathematics is a human activity from which we can take pleasure (Breen, 2007; Simon, 2007). Karen recognizes her students' potential for working on mathematics and does what she can to support their growth. She also shows students her own interest in mathematics and the pleasure she receives from the subject matter. She resists the gatekeeper image of mathematics that often accompanies standardized assessment.

Third, I see stories of having to choose between forms of care: caring for students *or* caring for ideas. For example, kindergartens are sometimes described as places to care for the needs of young children, while high school classrooms are characterized by the subject matter that is studied. The spectrum of education becomes dichotomized into care for child or care for subject matter. I hear this when teachers assert that they teach *children* or that they teach *mathematics*. This dichotomization ignores the emotional, intellectual, and moral demands involved in caring both for students and ideas. The work of such caregivers is invisible. Through Karen's lived counterstory of caring both for her students and for mathematical ideas, we can begin to "uncover the hidden work, knowledge, and notions of good embedded in expert caring" (Gordon, Benner, & Noddings, 1996, p. xv). By highlighting the complexities of caring teaching, experienced and beginning teachers (Ambrose, 2004) might find new ways to approach mathematics and to engage with students.

Returning to the Research Questions

As I write the last section of the last chapter, I find it a formidable task to think about this study in its entirety. Returning to the research questions that I began with is one way to focus this looking back over the whole of the dissertation while still leaving room for the maybes of looking ahead.

The research questions that framed this study are:

- **How does a teacher in an elementary classroom care both for her students and for mathematical ideas?**
- **What are the complexities of caring both for students and for mathematical ideas?**
- **How are the complexities related to and shaped by the subject of mathematics?**

I address the first question by thinking about the characteristics of care that were evident in Karen's classroom. Karen showed profound attention as she listened to students, supported them as they made sense of mathematical ideas, improvised around students' responses, and engaged in her own mathematical thinking. Reciprocity of care was evident as Karen worked to meet her students' needs and also made her own needs clear (for example, when a student was chatting, she expressed her need for him or her to listen). There was also reciprocity in the mathematics work that Karen and her students engaged in as they drew on the connections within the subject matter to solve new problems. Karen and her students received emotional and intellectual satisfaction from working on mathematics. Karen drew on proximity, a characteristic of care that I propose in Chapter 4, to carry students and mathematics close to her (physically, emotionally, and intellectually). These characteristics of care are only a part of how Karen and other teachers care. There is a flavour, an atmosphere, or a way of caring that is specific to each person. I chose to share my writing, such as the *day in the life* and the accounts from the classroom as a way to capture that inimitability on paper.

I can also point to some of the things that were special about Karen's classroom, though I do not think of this as a to-do list for care. Karen emphasized *making sense* as a way for all students to engage in mathematics. She used masterful improvisation as an essential part of responding to students and to their ideas. She pointed out and discussed powerful connections amongst ideas and amongst people, Karen allowed her familial relationships to shape her teaching practices. She used some spaces in the classroom to bring people close together and to allow them to be *close* to mathematics. Karen took student questions seriously; they sometimes caused Karen to think deeply about mathematics. She accepted mistakes as part of what it means to do mathematics, and she encouraged an atmosphere of conjecturing. These aspects were part of the mathematical way of life of Karen's classroom.

I evoke the contours and texture of care in Chapters 4 and 5 by describing and discussing Karen's caring work both with her Grade 6 students and with mathematics. Karen's emotional, intellectual, and moral work were also essential to care. It is hard work to care, yet Karen derived much satisfaction and pleasure from this work: "[teaching] is a huge responsibility . . . [but] you feel privileged as a teacher . . . it seems like the better you get at it the harder it gets." The *how* of Karen's care both for her students and for mathematics is still unfolding.

To address the second research question, I think about the word *both*. Karen managed to care, at the same time, both for students *and* for mathematics. While I maintain that caring for people is more important than caring for mathematics, somehow Karen managed both. I think in particular of Karen's response to Emily's questions about angles. Students knew that she cared for them first but that she also cared for the ideas of mathematics. In their interviews, students invariably characterized Karen as caring and recognized (often with a wry smile) her passion for mathematics. The complexities surrounding the conjoining of these two forms of care became apparent in Karen's classroom. Caring for students and for mathematics at the same time was challenging because it involved emotional, intellectual, and moral work. There were the ghosts of the classroom to consider (both Karen's ghosts and her students' ghosts), as well as personal, familial, community, and social contexts. The subject matter was an important and necessary part of their lives together. It was in the context of mathematics (and other subject matter) that Karen and her students encountered one another. I do not view the complexities as limitations on care, but rather, as Karen did with her daughter Anna and her student Mariah, as sources of insight for imagining new ways of caring.

Karen managed to care both for her students and for mathematics as part of her daily work in the classroom. Karen's work adds a new aspect to conversations in mathematics education and suggests questions for the teaching and learning of mathematics. An elementary teacher can care both for people and for ideas. How might this foregrounding of both forms of care be enacted in other contexts such as high school and university mathematics classrooms or in mathematics curriculum and pedagogy courses for education students? In these contexts, instructors might focus more strongly on the mathematical ideas or on the people involved (including the future students of education students). Karen's example shows that care can be flexible and contextual. In the context of mathematics, the two forms of care can sustain and support one another, but they can also block one another. How might these complexities of care be discussed and brought to life in other mathematical contexts?

The complexities of care in Karen's classroom were also shaped by the subject matter of mathematics, the heart of my third research question. For example, the response that can come from working on mathematics was blocked by accepted mathematical conventions for notation of angles. When this happened, it was the care between Karen and Emily that sustained the care for the mathematics. When Aidan and Thomas were conjecturing, their care for mathematics nurtured the relationship between the two students. The two forms of care are not independent, but they interplay in complex, and sometimes synergistic, ways.

Though I have spent much time and many pages exploring these three questions alongside Karen, her students, my own family and friends, and various academic works, to me the questions still seem open. I offer some of my deeply rooted maybes as ways to think about the questions. I can imagine re-visiting the spirit of the questions within the field texts to ponder some aspects more fully: the role of students in care, the influences of classroom materials on the possibilities for care, family stories of care (especially with respect to mathematics), as well as other sites of care within mathematics. The research questions and field texts are spacious enough for continued consideration.

The maybes of this chapter provide me with direction for future research. How does mathematics provide a good context for the emotional, intellectual, and moral work of care? I think there is something special about the work of care in mathematics. I can point to some distinctive aspects in the sites of care I have examined.

The three sites of care explored in Chapter 5 are indifference, mistakes, and conjecturing. The indifference of mathematics can block care because of the arbitrary aspects inherent in the indifference, but it also can also provoke mathematical discussions and thinking. Mistakes provide opportunities for deeper engagement with mathematics and a feeling of reciprocity through the sense students make from that engagement. Mistakes also provide a healthy place (within the indifference of mathematics and alongside a caring teacher) for learning to deal with frustration. Conjecturing offers a safe space for exploring both mathematical and personal relationships. I chose to explore these three sites of care, but there were many other sites in Karen's classroom. Further inquiry into other sites could highlight more complexities between mathematics and the work of care.

My wonderings about what mathematics has to offer to an ethic of care might also lead to new questions about the place of mathematics in schools, especially elementary schools. If mathematics can provide a fruitful and safe context for the work of care, how might teachers and other educators bring this to bear on their work with students? How might parents, administrators, and curriculum developers participate in and sustain this work? How might teachers and students draw on the reciprocity available through caring for mathematics to stimulate other forms of care? How might mathematics educators use an ethic of care to work with students on mathematics and to engage in mathematics education research? Through this study, I think that there are many possibilities for expanding both mathematics and an ethic of care in teaching practice as well as in the philosophical sense. For example, generalizations and indifference in mathematics provide challenges to care, but they also allow possibilities for deepening care both for people and for ideas. This leads me to a wider wondering: what are the challenges to and possibilities for care in an educational system that relies on general constructs of learning and learners in order to support the growth and learning of unique students and teachers?

Another wondering emerges: what does an ethic of care offer to mathematics? In the related literature on care that I have shared, there is an emphasis on connectedness and relation. There are possibilities for school mathematics to be transformed by valuing and exploring connected ideas and relations amongst numbers, shapes, and other mathematical representations. Perhaps popular images of school mathematics could include webs of understanding, as opposed to bits of disconnected information or rules. An ethic of care emphasises the particular, as carers recognize and respond to individuals as well as attending to the context. In mathematics, too much particularization can interfere with mathematical generalizations. For example, imagine finding out all the particularities of the context of a word problem (the who, what, when, where, and why). This is probably not helpful in solving the problem. It does not meet the "needs" of mathematics. Perhaps care can offer ways to think about generalizations in terms of the particular; a generalization might be described as *connected* particularities if teachers and students explore particular contexts and the relations amongst them with the explicit intent of understanding and creating an appropriate generalization.

A final wondering that has developed from this study is around the possibilities for care in my life. As I read, write, and go about my daily routines, I see connections to care everywhere. An ethic of care has provided for me not only a framework and a topic for this study, but also a coherent way of looking at the world. I began this dissertation by writing about my birthright of care that has been nurtured by my family and friends. How do I carry on this birthright to care in classrooms and in academia, while continuing to explore critically possibilities for care in mathematics education? Karen's classroom has shown me that care is full of possibility for emotional, intellectual, and moral work alongside people and ideas. My work as an academic involves both people and ideas through reading, writing, teaching, researching, and serving my various communities. An ethic of care has deep roots in my life and in this research. I imagine that an ethic of care will continue to nourish my life in academia as I search for new ways to care both for people and for ideas. Care offers me a way forward.

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APPENDIX A

Fictional accounts presented to students in year-end interviews

Account A	**Account B**
Nathan was distracted and had a hard time finishing his math work. He moved to the C-table, put his head on the table for a while, and then started working again.	Ellie talked about her strategy for winning 3-5-7. She explained that, when it comes to math, she isn't very good at calculating, but that she's really good at math games, especially this one. She explained that she has a really good strategy that just works.
Account C	**Account D**
The last question on the page was 1500 m = ____ km. Quincy showed his work on the overhead. He explained that 1000 m is 1 kilometre and 500 m is half a kilometre or 0.5 km. So, he continued, 1500 m is 1.5 km.	Jane asked Ava how she had added two decimal numbers together. Ava explained that she lined them up like this: 1.23 +23.5 She then said that she added 'like always' for an answer of 3.58.

APPENDIX B

Information letters and consent forms for teacher and students

Information letter (teacher)

Julie Long
Department of Elementary Education
551 Education South
University of Alberta
Edmonton AB T6G 2G5

e-mail: jslong@ualberta.ca

Dear ___________,

My name is Julie Long and I am a doctoral student at the University of Alberta in the Department of Elementary Education. As a former elementary teacher, I am interested in how you as a teacher care both for your students and for mathematical ideas. As teachers, we are carers for students. At the same time, we care about ideas. There are similarities and differences in caring for people and caring for ideas. In order to explore these similarities and differences, I would like to conduct a research study for my doctoral dissertation in your classroom beginning in February of 2007 and lasting approximately four months.

I would like to observe you and your students in your classroom on a daily basis for about four months and record, through notes and audio-taped conversations outside of class, your experiences of care involving students and mathematics. At the beginning of the study, I would also like to accompany you and/or the students during the school day, allowing us the time to become acquainted and form trusting relationships. Occasionally, I may enter into conversations with you and your students while I am in the classroom. These conversations will be informal and will not take the form of interviews. As the study progresses, the informal conversations may be audio recorded. At times, I might also like to photograph you, your students, and/or photocopy your work together. I will show parents/guardians any images of their children's work, and/or (digitally) obscured images of the children that I wish to publish, and request their permission to do so via the use of image release forms. Additionally, if you or your work appears in any of the images, I will request your permission to use them in my work via the use of image release forms, once you have seen the images. Should parental permission not be granted for a particular child within the class, no data will be collected for that individual.

In addition, I would like to meet with you once a week for about an hour to write about and discuss your experiences of care in your classroom. These conversations would be audio-recorded. At the end of the study, I would also like to interview students about their ideas of care (also audio-recorded) involving mathematics. Additionally, transcripts of our taped conversations as well as drafts of the dissertation will be reviewed with you and amended accordingly to ensure that your voice is represented in ways that honour your intentions. Following the completion of my analysis and dissertation writing, I anticipate meeting with you at a mutually convenient time to share the findings of the study.

As the primary researcher, I will carry out the fieldwork and subsequent writing. Should a transcriber be used to assist the inquiry, I will review the ethical standards with him/her and have a confidentiality agreement completed to ensure that ethical procedures are followed.

You can withdraw at any time during the study without penalty. If you withdraw, the data collected from observations, conversations, and other activities will not be used. You have the right to withdraw at any time during the study without penalty.

All of my research requests and methods will first be approved by the University of Alberta (Faculties of Education, Extension and Augustana Research Ethics Board), your school district, school principal, and the parents/caregivers of your students. I will draw up the required information letters and consent forms for parents/caregivers, and other school officials, and look after the distribution of these. Participant confidentiality will be safeguarded, and anonymity maintained via the use of pseudonyms, and where applicable, the digital obscuring of photographs.

Thank your for your consideration of this research request. Your experience as a caring teacher will be an essential component of this proposed research. For questions or clarification, I may be reached at the contact information listed above. You may also contact Dr. Lynn McGarvey (research supervisor) at lynn.mcgarvey@ualberta.ca or the Chair of the Department of Elementary Education is Dr. Dianne Oberg (doberg@ualberta.ca) for more information.

Sincerely,

Julie Long, M. Ed.
Doctor of Philosophy Candidate

Information letter (parent/caregiver)

Julie Long
Department of Elementary Education
551 Education South
University of Alberta
Edmonton AB T6G 2G5
e-mail: jslong@ualberta.ca

Dear Parent/Caregiver,

My name is Julie Long and I am a doctoral student at the University of Alberta in the Department of Elementary Education. My areas of interest are mathematics and care. In order to explore how mathematics is related to care, I would like to conduct a research study for my doctoral dissertation in your child's classroom beginning in February of 2007 and lasting approximately four months.

I would like to observe students in their classroom on a daily basis and record, through notes and audio-taping of informal conversations and an interview, their experiences of care in their interactions with the teacher, other students, and mathematics tasks. At the beginning of the study, I would also like to accompany the students during the school day, allowing us the time to become acquainted and form trusting relationships. Occasionally, I may enter into conversations with your child while I am in the classroom. These conversations will be informal, and will not take the form of interviews. As the study progresses, the informal conversations may be audio recorded. At times, I might also like to photograph students and/or photocopy portions of their work. When photographing, efforts will be made to avoid taking identifiable pictures of students. When this is not possible, digital processes will be used to obscure the identity of children. I will share the photos will you and will request your permission to use these images via the use of an image release form.

At the end of the study, I would also like to interview students about their ideas of care (audio-recorded) involving mathematics. The interview would last less than an hour. If you choose not to have your child participate, no data will be collected for him/her.

You or your child can withdraw at any time during the study without penalty. If you withdraw, the data collected from observations, conversations, and other activities will not be used. You have the right to withdraw at any time during the study without penalty.

All of my research requests and methods are approved by the University of Alberta (Faculties of Education, Extension and Augustana Research Ethics Board), your school district, school principal, and the classroom teacher.

Participant confidentiality will be safeguarded, and anonymity maintained via the use of pseudonyms, and where applicable, the digital obscuring of photographs.

Thank you for your consideration of this research request. Can you please complete and return the enclosed consent form to indicate whether or not you give permission for your child to participate? For questions or clarification, I may be reached at the contact information listed above. You may also contact Dr. Lynn McGarvey (research supervisor) at lynn.mcgarvey@ualberta.ca or the Chair of the Department of Elementary Education is Dr. Dianne Oberg (doberg@ualberta.ca) for more information.

Sincerely,

Julie Long, M. Ed.
Doctor of Philosophy Candidate

Consent form (teacher)

Researcher
Julie Long
Department of Elementary Education
551 Education South
University of Alberta
Edmonton, Alberta T6G 2G5

email: jslong@ualberta.ca

Description of the Research
The purpose of this research is to study the relationships between care and mathematics. The foreseen harms of participating in this study include possibly being uncomfortable while discussing care involving students and ideas. This is potentially an emotionally charged topic. Possible benefits of the study include an increased awareness of care in the classroom, guidance in developing accounts of teaching practice, and opportunities to reflect upon experiences.

In order to protect the interests of the participants, we will adhere to the following guidelines:

1. The researcher will observe in your classroom on a daily basis beginning in February 2007 for a period of up to four months. The time spent with the students and teacher will include mathematics class and may include other classes as well as recess and lunch hour. The daily interval of time in the classroom will be agreed upon together by you and the researcher.

2. The researcher may enter into conversations with you and your students while in the classroom.

3. The researcher will be non-obtrusive and sometimes act as a classroom volunteer/helper as deemed appropriate by you, the classroom teacher.

4. Participant confidentiality will be safeguarded and anonymity maintained via the use of pseudonyms and, where applicable, the digital obscuring of photographs. Students, the teacher, and their work may be photographed, photocopied, and/or audio taped and the images may be included in the researcher's doctoral dissertation and be used in academic publications. If you or your work appears in any of the images, they will be shared with you and your permission to use the images will also be sought via the use of image release forms. Efforts will be made to avoid taking identifiable pictures of the teacher and students, otherwise digital processes will be used to obscure the identity of the teacher and children. The (digitally-obscured) images may be included in the researcher's doctoral dissertation and be used in academic publications and presentations. The images of interest will be shared for your approval and image release forms will be offered for your signature prior to

the publication of any images.

5. Any data collected via researcher-notes, photographs, and audio recordings will be kept in a secure place for a minimum of five years following completion of the research. It will then be destroyed.

6. The researcher will acknowledge that you can withdraw at any time during the study without penalty. If you withdraw, the data collected from observations, conversations, and other activities will not be used. You have the right to withdraw at any time during the study without penalty.

7. The researcher will advise you of any new information that will have a bearing on your decision to continue in the study.

8. The researcher will be sharing research texts with you in order to ensure that your voice represents your intentions.

9. The results of the study may be used for the researcher's doctoral thesis in education. The study might also be published as an article in a scholarly journal, or presented at a conference. The confidentiality and anonymity of you, your students, and your school will be protected through the use of pseudonyms and, where applicable, the digital obscuring of photographs. The use of all research data will be handled in compliance with University of Alberta ethical standards.

10. Research assistants involved in transcribing the audio recordings will comply with University of Alberta ethical standards and will sign confidentiality agreements.

11. You may contact Julie Long (researcher) at jslong@ualberta.ca, or Dr. Lynn McGarvey (research supervisor) at lynn.mcgarvey@ualberta.ca. The Chair of the Department of Elementary Education is Dr. Dianne Oberg (doberg@ualberta.ca).

12. The plan for this study has been reviewed for its adherence to ethical guidelines and approved by the Faculties of Education and Extension Research Ethics Board (EE REB) at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Chair of the EE REB at (780) 492-3751.

Agreement

I, ________________________________, agree to participate in the above study. I am aware of the nature of the study, and understand what is expected of me. I also understand that I am free to withdraw at any time throughout the study.

______________________________ ____________________
Participant's Signature Date

______________________________ ____________________
Researcher's Signature Date

I, ________________________________, do not agree to participate in the research study at this time.

A copy of this consent form and information letter is provided for your records.

Consent form (parent/caregiver)

Researcher
Julie Long
Department of Elementary Education
551 Education South
University of Alberta
Edmonton, Alberta T6G 2G5
email: jslong@ualberta.ca

Description of the Research
The purpose of this research is to explore the relationships between care and mathematics. There are no foreseen harms associated with your child's participation in this study. Possible benefits of the study include an increased awareness of care in the mathematics classroom and opportunities to reflect upon experiences.

In order to protect the interests of the participants, we will adhere to the following guidelines:

1. The researcher will observe in your child's classroom on a daily basis beginning in February 2007 for a period of up to four months. The time spent with the students and teacher will include mathematics class and may include other classes as well as recess and lunch hour. The daily interval of time in the classroom will be agreed upon together by the teacher and the researcher.

2. The researcher may enter into conversations with your child while in the classroom.

3. The researcher will be non-obtrusive and sometimes act as a classroom volunteer/helper as deemed appropriate by the classroom teacher.

4. Participant confidentiality will be safeguarded and anonymity maintained via the use of pseudonyms and, where applicable, the digital obscuring of photographs. Students, the teacher, and their work may be photographed, photocopied, and/or audio taped and the images may be included in the researcher's doctoral dissertation and be used in academic publications. If your child or your child's work appears in any of the images, they will be shared with you and your permission to use the images will also be sought via the use of image release forms. Efforts will be made to avoid taking identifiable pictures of the teacher and students, otherwise digital processes will be used to obscure the identity of the teacher and children. The (digitally-obscured) images may be included in the researcher's doctoral dissertation and be used in academic publications and presentations. The images of interest will be shared for your approval and image release forms will be offered for signatures prior to the publication

of any images.

5. Any data collected via researcher-notes, photographs, and audio-taped recordings will be kept in a secure place for a minimum of five years following completion of the research. It will then be destroyed.

6. The researcher will acknowledge that you and your child can withdraw at any time during the study without penalty. If you or your child withdraws, the data collected from observations, conversations, and other activities in which your child was the focus will not be used.

7. The researcher will advise you of any new information that will have a bearing on your decision to continue in the study.

8. The results of the study may be used for the researcher's doctoral thesis in education. The study might also be published as an article in a scholarly journal, or presented at a conference. The confidentiality and anonymity of your child and his/her school will be protected through the use of pseudonyms, and where applicable, the digital obscuring of photographs. The use of all research data will be handled in compliance with University of Alberta ethical standards.

9. Research assistants involved in transcribing the audio recordings will comply with University of Alberta ethical standards and will sign confidentiality agreements.

10. You may contact Julie Long (researcher) at jslong@ualberta.ca, or Dr. Lynn McGarvey (research supervisor) at lynn.mcgarvey@ualberta.ca. The Chair of the Department of Elementary Education is Dr. Dianne Oberg (doberg@ualberta.ca).

11. The plan for this study has been reviewed for its adherence to ethical guidelines and approved by the Faculties of Education and Extension Research Ethics Board (EE REB) at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Chair of the EE REB at (780) 492-3751.

Agreement

I, ________________________________, (print parent's name) have read the above guidelines, and agree to have my child __________________________(print child's name) participate in the study. I am aware of the nature of the study, and understand what is expected of me. I also understand that I am free to withdraw at any time throughout the study.

____________________________ ____________________

Student's Signature Date

____________________________ ____________________

Parent/Guardian's Signature Date

____________________________ ____________________

Researcher's Signature Date

I, ________________________________ (print parent's name), do not agree to have my child ________________ (child's name) participate in the research study at this time.

A copy of this consent form and information letter is provided for your records.

******* Please return one copy of the consent form to your child's teacher. *******

APPENDIX C

Image release forms for teacher and students

Researcher
Julie Long
Department of Elementary Education
551 Education South
University of Alberta
Edmonton, Alberta T6G 2G5

email: jslong@ualberta.ca

I, _____________________, (teacher's name) agree to release attached photographs of myself collected by the above-named researcher. I understand that the images may appear in the researcher's dissertation, and/or in subsequent scholarly articles and presentations. The procedure and its possible risks have been explained to me by Julie Long (through an information letter) and I understand them. I understand that my participation is completely voluntary and that I may choose to withdraw from the study up to June 30, 2007 without penalty. I also understand that although the data from this study may be published and/or presented at seminars and/or conferences, my identity will be kept completely anonymous and my words and comments are confidential. Participant confidentiality will be safeguarded, and anonymity maintained via the use of pseudonyms and, where applicable, the digital obscuring of photographs and audiotapes.

___________________________ ___________________
Signature Date

___________________________ ___________________
Researcher's Signature Date

The plan for this study has been reviewed for its adherence to ethical guidelines and approved by the Faculties of Education and Extension Research Ethics Board (EE REB) at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Chair of the EE REB at (780) 492-3751.

A copy of this consent form is provided for your records.

Researcher
Julie Long
Department of Elementary Education
551 Education South
University of Alberta
Edmonton, Alberta T6G 2G5

email: jslong@ualberta.ca

I, ____________________, (print parent's name) agree to release attached photographs of _________________ (print child's name) collected by the above-named researcher. I understand that the images may appear in the researcher's dissertation, and/or in subsequent scholarly articles and presentations. The procedure and its possible risks have been explained to me by Ms. Long (through an information letter) and I understand them. I understand that my participation and my child's participation are completely voluntary and that we may choose to withdraw from the study up to June 30, 2007 without penalty. I also understand that although the data from this study may be published and/or presented at seminars and/or conferences, my child's identity will be kept completely anonymous and my child's words and comments are confidential. Participant confidentiality will be safeguarded, and anonymity maintained via the use of pseudonyms and, where applicable, the digital obscuring of photographs and audiotapes.

____________________________ Student's Signature	__________________ Date
____________________________ Parent/Guardian's Signature	__________________ Date
____________________________ Researcher's Signature	__________________ Date

The plan for this study has been reviewed for its adherence to ethical guidelines and approved by the Faculties of Education and Extension Research Ethics Board (EE REB) at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Chair of the EE REB at (780) 492-3751.

A copy of this consent form is provided for your records.

APPENDIX D

Confidentiality agreement

I, ______________________________, the *transcriber* have been hired to *transcribe interviews between the researcher and her research participants.*

I agree to -

1. keep all the research information shared with me confidential by not discussing or sharing the research information in any form or format (e.g., disks, tapes, transcripts) with anyone other than the *Researcher*.

2. keep all research information in any form or format (e.g., disks, tapes, transcripts) secure while it is in my possession.

3. return all research information in any form or format (e.g., disks, tapes, transcripts) to the *Researcher* when I have completed the research tasks.

4. after consulting with the *Researcher,* erase or destroy all research information in any form or format regarding this research project that is not returnable to the *Researcher* (e.g., information stored on computer hard drive).

Transcriber

______________________	______________________	____________
(Print Name)	(Signature)	(Date)

Researcher

______________________	______________________	____________
(Print Name)	(Signature)	(Date)